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Weapons Junkies

What has been Americas most nurturing contribution to the culture of this planet so far? Many would say jazz. 1, who love jazz, will say this instead: Alcoholics Anonymous.

I am not an alcoholic. If I were, I would go before the nearest AA meeting and say, "My name is Kurt Vonnegut. I am an Alcoholic." God willing, that might be my first step down the long, hard road back to sobriety.

The AA scheme, which requires a confession like that, is the first to have any measurable success in dealing with the tendency of some human beings, perhape ten percent of any population, to become ad* dieted to substances that give them brief spasms of pleasure, but in the long term transmute their lives and the lives of those around them to ultimate ghastliness.

The AA scheme, which, again, can work only if the addicts regularly admit that this or that chemical is poisonous to them, is now proving its effectiveness with compulsive gamblers, who are not dependent on chemicals from a distillery or a pharmaceutical laboratory. This is no paradox, Gamblers, in effect manufacture their own dangerous substances. God help them, they produce chemicals that elate them whenever they place a bet on simply anything. If I were a compulsive gambler; which I am not, I would be well advised to stand up before the nearest meeting of Gamblers Anonymous and declare, "My name is Kurt Vonnegut. I am a compulsive gambler''

Whether I was standing before a meeting of the Gamblers Anonymous or of the Alcoholics Anonymous, 1 would be encouraged to testify as to Row the chemicals I had generated within myself, *or* swallowed had alienated my friends and relatives, cost me jobs and houses, and deprived me of my last shred of self-respect.

I now wish to call attention to another form of addiction, which has not been previously identified. It is more like gambling than drinking, since the people afflicted are ravenoum for situations that will cause their bodies to release exciting chemicals into their bloodstreams. I am persuaded that there are among us people who are tragically hooked on preparations for war. Tell people with that disease that war is coming and we have to get ready for it, and for a few minutes there they will be as happy as a drunk with his martini breakfast or a compulsive gambler with his paycheck bet on the Super Bowl.

Let us recognize how sick such people are. From now on, when a national leader, or even just a neighbor, starts talking about some new weapons system that is going to cost us a mere twenty-nine billion dollars, we should speak up. We should say something on the order of, "Honest to God, I couldn't be sorrier for you if I'd seen you wash down a fistful of black beauties with a pint of Southern Comfort." I mean it. I am not joking. Compulsive preparers for World War 3, in this country or any other, are as tragically and repulsively addicted as any stockbroker passed out with his head in a toilet in the Port Authority bus terminal.

For an alcoholic to experience a little joy, he needs maybe three ounces of grain alcohol. Alcoholics, when they are close to hitting bottom, customarily can't hold much alcohol. If we know a compulsive gambler who is dead broke, we can probably make him happy with a dollar to bet on who can spit farther than someone else. For us to give a compulsive war-preparer a fleeting moment of happiness, we may have to buy him three Trident submarines and a hundred intercontinental ballistic missiles mounted on choo-choo trains.

If Western Civilization, which blankets the world now, as far as I can tell, were a person—if Western Civilization, which surely now includes the Soviet Union and China and India and Pakistan and on and on, were a person—we would be directing it to the nearest meeting of War Preparers Anonymous. We would be telling it to stand up before the meeting and say, "My name is Western Civilization. I am a compulsive war-preparer. I have lost everything I ever cared about. I should have come here long ago. I first hit bottom in World War 1".

Western Civilization cannot be represented by a single person, of course, but a single explanation for the catastrophic course it has followed during this bloody century is possible. We the people, because of our ignorance of the disease, have again and again entrusted power to people we did not know were sickies.

And let us not mock them now, any more than we could mock someone with syphilis or smallpox or leprosy or yaws or typhoid fever or any of the other diseases to which the flesh is heir. All we have to do is to separate them from the levers of power, I think

And then what? Western Civilization's long hard trip back to sobriety might begin.

Kurt Vonnegut Jr
The Nation January 7. 1984).

From the Editor's Desk

Recently, there has been unusual interest in the Nuclear Nonproliferation Treaty (NPT) amongst commentators and think-tankers in India. Some have advocated that India should declare itself a full-fledged nuclear weapons state and join the treaty in that capacity. However, the debate has totally missed a most vital point.

NPT is based on false premises. When the treaty was first signed (July 1st, 1967), the nuclear haves asked the nuclear have-note to forgo their sovereign right to make nuclear weapons. In return, the have-nots were promised the following:

- The nuclear haves were to 'seek* a comprehensive test-ban treaty and discontinue all (underground) nuclear weapons' tests.
- They were to negotiate among themselves with an aim to 'pursue' "in good faith" efforts towards reductions in their own arsenals.
- They were to refrain from threat or use of force on non-nuclear states in accordance with the U.N. charter.
- They were to cooperate in contributing to the further development of the application of nuclear energy for peaceful purposes including any peaceful applications of nuclear explosions.

Discussion on NPT in India has tended to concentrate on the failure of the nuclear haves to implement the first three points. There has been little or no discussion regarding the fourth point.

The experience of the last 25 years of "application of nuclear energy for peaceful purposes' has shown that nuclear energy is a poisoned source of power and its use has to be abjured by all if we are to preserve the planet for future generations. The sufferings of the people of Kazakh istan and the Pacific bear ample testimony to the 'benefits' of 'peaceful nuclear explosions'.

No self-respecting state can sign the NPT. India has no need to emulate others who have done so. Of course, it is moot question whether India is any longer a self-respecting nation which can make up its own mind on issues of vital concern. But not signing a patently discriminatory treaty does not mean that we should continue the present bankrupt policy of nuclear ambiguity.

Nuclear weapons are weapons of mass destruction. Their use or threat of use is only to terrorise the adversary. States possessing these weapons are truely 'terrorist' states. The correct way for other countries in the world community to deal with these bullies is to recognize them for what they are and to ostracize them. One certainly can not deal with terrorism by aspiring to become a terrorist oneself.

August 6 and August 9, 1945

Lest We Forget

Images of Hiroshima

An eighty-year-old woman of Mitaki township in Hiroshima lost her husband in the "flash" of the bomb; day and night she still tells her grandson Tomekichi the "flash story/' like a thread woven in childhood.

It was just like hell—a procession of ghosts, a sea of flames. But I didn't see the devil, so I thought it was something happening on this earth....
An atomic bomb doesn't just fall; someone has to drop it.

In the central bombed area, there were "two feet of a victim whose body had vanished in a single puff; they stood upright, stuck to the concrete road. Again, strangely, "in a streetcar a young girl lay dead, head to head with a dead, charred-black soldier; uninjured but with torn clothing, she still clutched her purse." But, "not a soul remained to tell us what happened at the center of the bombed area."

In the pond of the Sentei (Asano Mansion), live carp were swimming among the dead bodies.

When I came to my senses, I found my comrades still standing erect and saluting; when I said, "Hey," and tapped their shoulders, they crumbled down into ashes.

Food was distributed to the A-bomb victims. An old woman's grandchild was standing in line to receive rations. "In front of my grandchild, there was a young near-naked girl. After receiving rations for five persons, she fell forward on the ground and lay motionless/*

In the home of a sick soldier, his young wife was crushed between large, heavy beams, still holding her child in her arms. A man from next door tried to rescue her, but the beams were more than one man, or even two, could lift. Wanting to save her child at least, he cried, "Quick, give me the baby."But she said, "No, let us die here together. My husband is already dead, anyway. I can't leave this child alone. ..Hurry up! Escape while you can."

A mother in Mitaki township, who lost her husband in the atomic bombing, carried on her daily work valiantly; but on her arm where skin from her hip had been transplanted, the scar tissues continued to contract in autumn and winter, causing intense pain.

Everyone gathered at some stone steps and sat down. They included a woman losing her sight in one eye, a man getting sicker by the minute, another with a fierce headache. Everyone had external and internal injuries, but no one cried out in pain. Almost everyone was silent

It was a cruel and complete silence, worse than any other, like "a moan that cannot be voiced."

1 ran to wan! Tsurumi Bridge, jumping over stones and fallen trees as though I were mad. What did 1 see there? Countless people were struggling to get to the stream under the bridge. I could not distinguish men from women Their faces were swollen and gray; their hair stood on end. Then, raising both hands skyward and making soundless groans, they all began jumping into the river as though competing with one another.

The concrete wall opposite me had big, gaping holes in places. 1 approached it because some low, dark figures seemed to be sitting in a row at its base. I could hardly tell man from woman or child, nor could I distinguish their ages They were all but nude, sitting in a line, and their faces and bodies had swelled up and turned brown, as if by common consent. One had already become blind. Then I noticed a baby on someone's knee; the skin of its back was hanging down, as if a rotten, reddish loquat had been peeled off all around. Instinctively, I turned away from the sickening sight. They were all motionless and kept a strange silence. It seemed that the question of life and death was yet unsettled for them. I shuddered at the thought of being loaded on a truck with these people.

Soon she lost consciousness. When, a full day later, she regained consciousness, a new realization swept over her: "I'm blind." / tried to raise my hands, but my right hand was heavy and beyond my control. With the fingers of my left hand I touched my face lightly; my eyebrows, my cheeks, and my mouth felt like a mixture of bean curd and gelatine. My face was swollen, like a big sponge; it was as I had no nose. I shuddered as I suddenly remembered the spooky shapes at the foot of the concrete wall."

The other side

For my part, however, I was within 1.5 kilometres of the hypocenter at bombing time and suffered only slight exposure symptoms, and am at present in relatively good health. Morevoer, my parents, my wife — who at that time was a second year student in a girls' high school and was equally exposed to the bomb — and my three children born in the decade 1955-1965 are all in good health. I therefore tried to be as optimistic as possible, so long as no further ill effects appeared.

I have long wondered why virtually all of the "A-bomb literature" consists of stories of the miserable people who have not recovered their health, as well as the descriptions of radiation symptoms and psychology of the A bomb survivors.

Why are there no stories of families who endured hard times, but recovered their health and now live as normal human beings? Must all survivors eventually meet a tragic death caused by radiation aftereffects? Is it not possible for the victims to overcome their illnesses, and their psychological anxieties and die a natural death like other people? Musfour deaths be used as data for opposing atomic bombs?

Undeniably, our lives were distorted and tormented by the bomb. Yet many other people, though they did not experience the atomic bombings, nonetheless endured the war and knew suffering of varying degrees. Therefore, I am determined not to indulge myself in the victim complex that some victims in Hiroshima have developed. I want my body and soul to recover.

From Hiroshima Notes
by Kenzaburo Oe (1965)

Unabated Suffering

Hibakusha is the Japanese word for the atomic bomb survivors. This article which has been excerpted from a long paper presented at the IInd Radiation Victims Conference at Berlin last year details their present suffering.

We questioned 1233 Hibakusha whose mean age was 59.5 years, 1985-90. According to our investigation of the Hibakusha, more than 50 percent of those surveyed underwent repeated hospitalisation. More than 90 percent of those surveyed were under treatment at the time of the survey which was two and a half times higher than the standard rate for other Japanese of the same age group. Incidence of lumbago (28.4% among the Hibakusha) is 3.6 times higher than the corresponding standard, hypertension (23.9%, 1.7 times), ocular disease (18% 5 times) neuralgia and myalgia(12.3%, 4.7 times), anemia and leukopenia(12.1%, 13.4 times), gastritis (9.9%, 4.5times), gastroduodenal ulcer(9.8%, 4.7 times), ischemic heart disease (9.8%, 4.7 times), liver disease (9%,6.4 times), diabetes (8.2%, 2.7 times) and others are relatively high, as well as high incidences of cancer and leukemia that are well known to be caused by radiation? These higher incidences strongly suggest that such general diseases are related to the radiation exposure of the A-bomb.

The high incidences of medical treatment found in the Hibakusha of Hiroshima/Nagasaki cannot be explained by mere stress. The high rate should be regarded as an indication that they were really ill because of radiation exposure.

We find similar results to ours indicating high incidences of diseases like hypertension and liver disease other than cancer and leukemia, in investigations undertaken by other groups previously. In a paper undertaken for "the NGO's symposium on the problems of the Hibakusha, 1977", the authors investigated 715 Hibakusha and reported the higher incidences of disorders of blood and Bone mar-

row, circulatory system, gastrointestinal system, and skin and subcutaneous tissue, compared to the general Japanese people. The incidences of these diseases are higher especially among the Hibakusha who had acute radiation injuries. In another investigation undertaken during 1985-86 by the "Japanese Council of Hibakusha", 13169 Hibakusha were investigated whose mean age was 62. The result indicated that the incidence of arthritis, lumbago, and rheumatism (41.3% among the Hibakusha, 3.9 times higher than general people), hypertension* and ischemic heart disease (36.5%, 2.3 times), cataract and ocular disease (20%, 5.6 times), skin disease (17.9%, 10.5 times), blood disease (17.5%, 19.4 times), gastro-ducdenal ulcer (14.9%, 10.5 times), liver disease (14.8%, 10.6 times), and diabetes (12.3%, 4.1 times) were high among the Hibakusha.

Moreover, statistics from 1968-82 about the cause of death of survivors of Hiroshima show that the number of deaths due to general health disorders such as tuberculosis, diabetes mellitus, blood/bone marrow disease, hypertensive disease, and liver cirrhosis are significantly larger among the Hibakusha, compared to general population.

Genbaku Bura-Bura disease

Many Hibakusha have frequently complained of such subjective symptoms as tiredness, vertigo, palpitations, lumbago, back pain, stiff shoulders and neck pains. These symptoms have collectively been called "Genbaku (atomic bomb) Bura Bura (lingering) disease." We believe that this is an important syndrome that should be regarded as a result of radiation exposure: A similar syndrome was reported also among the Chernobyl children.. These symptoms should not be ignored by ascribing them to mere stress.

Characteristics

The lingering disease consists of many symptoms that indicate a general damage of physiological functions. Characteristics are divided into various categories: general symptoms such as tiredness and fatigue, indication of damage to the immune system (easy to catch colds, etc.), those of the autonomic nervous system related to the control of whole internal organs, including the circulatory system (vertigo, palpitations, etc.) and those of the nervous and motor systems (stiff shoulders, neck pains, headache, lumbago, back pains and numbness of limbs). Our survey of the history of the disease and lives of the Hibakusha showed that the appearance of the symptoms in the period of a few to 10 years after the A-bombing is somewhat different from that at present. The lingering disease in the early stages was more severe than now, and, in extreme cases, symptoms suddenly becomes so serious that patients were bedridden. Such cases are rare, and the symptoms seem to be chronic today. We are taking medical care of the Hibakusha in our hospital and we ofteh see among them health disorders showing such conditions as, liable to catch colds", "susceptible to illness", and "difficult recovery from ill health".

Correlation between symptoms and radiation exposure

The following finfling* suggest a correlation between symptoms and radiation exposure:

- The rates of subjective symptoms found among the Hibakusha are higher than those found in the general population.

- Those who suffered acute. symptoms after the A-bombings (i.e. those who received high doses), show a higher level of bura-bur a symptoms.

- Similar symptoms are common among nuclear power plant workers exposed to radiation.

- Similar symptoms are seen among radiation victims in other countries.

Total Neglect

The name of the syndrome, bura-bura disease, reflects the fact that most hibakusha always felt very lethargic. Because many of them looked healthy enough on the outside they were regarded as habitual malingerers and discriminated against by the socity. Many committed suicide to avoid the stigma and after repeated rejections in the marriage and job markets. The Japanese government did not provide any financial or medical support to the Hibakusha for more than ten years after the atomic bombings. It was only after a public movement that a law giving relief to the Hibakusha was enacted.

Never Ending Saga

A health survey of the second generation of the Hibakusha in Nagasaki revealed high rates of sickness. The mean age of the group of 1023 persons investigated was 31 years. 22.8% said that they were taking treatment for some disorder at the time of the investigation which is twice as high as the rate in the general population of the same age group.

We demand that a "national compensation law" be enacted for the Hibakusha including the second and third generation victims. We want to join hands with the world wide movement of radiation victims.

Of Katsumi Funstu, Kazue Sadamori.
Masako inornata, Dr Saburo Murata
Haman ChuoHospital

The Price of Greatness

The author of this article, Sam Day ***is a person with an immense am mount of common sense. Although at first*** *glance this article has very little to do* ***with Anumukti, we are reproducing it in full since the mindset it describes,is*** *not confined to U.S. alone but applies equally* ***well to the people*** *in* ***the corridors of power in Delhi. Happy would be*** *the day when we in India would give up* ***notions*** *of* ***being a regional power and look deeply into what constitues real*** *greatness.*

Studente, professors and practitioners of American foreign policy often use the term "Great Power" in referring to the role of the United States and a few other nations on the world stage. They think of this country not only as a Great Power but as the last remaining Superpower.

I was reminded of this by Secretary of State Warren Christopher's explanation of the Clinton Administration's decision to involve the United States in settlement — including use of ground troops, if necessary — of the war now ravaging what used to be Yugoslavia. No Great Power, said Christopher, could stand aloof from conflict or instability in such a strategic part of the world.

What is a Great Power, I wondered. What distinguishes the great power of U.S.A. from the lesser power of the other nations? What does it mean to be a Great Power, and what are the costs and benefits of this special status?

Being citizens and taxpayers of Great power, it seems, means that Americans—rather than, say, New Zealanders—get to kill and be killed in separating the blood-feudere in Europe's ancient Balkan tinderbox.

It means that Americans—rather than, say, Swedes get to continue picking up the $50-billion a year U.S. share of the tab for maintaining the North Atlantic Treaty Organization (NATO), the base for the military operations in Europe and the Middle East as well.

It means the United States and not the Dutch or Canadians or Cubans, get to send our carrier battle groups and floating marine battalions to the Adriatic Sea, the Indian Ocean and the Persian Gulf to ensure stability in those far-flung regions.

It means the United States, not Japan or Australia, gets to fly the flag and carry a big stick at Singapore, where Britannica once ruled the waves at the crossroads of the Far East.

For Warren Christopher and others in the foreign policy establishment there are obvious benefits from being a Great Power. In foreign ministries a representative of the United States carries a bit more clout than someone from Denmark or Belgium.

Two other categories of beneficiaries come to mind. Materially, there is the military-industrial complex, which depends on the hundreds of billions of dollars a year needed to nourish great powerdom. Spiritually, there is the satisfaction many derive from the sense of being associated with Number One.

What are the costs of being a Great Power? They have been encountered through the centuries by countries—Rome, Portugal, Spain, Britain—that rose and then collapsed as Great Powers, exhausted by the burdens of empire, For the United States today the cost are apparent in a crippling national debt, federal budget gridlock, deteriorating economic competitiveness, collapsing infrastructure, eroding social services...

Every lesser power cited above-New Zealand, Sweden, Holland, Cuba, Canada, Norway, Denmark, Japan, Australia, Belgium, Luxembourg—now leads this Great Power in the quality of the social safety net available to its citizens, child care, and protection of the old and infirm.

We have a lot to learn from these lesser but wiser powers—poorer in guns but richer in their quality of life about what really constitutes greatness.

Sam Day
Nukewatch

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Uranium, Plutonium, Pandemonium

Two years ago, The Economist magazine from London was waxing eloquent about "the charms of nuclear power". The present article shows that even die-hard true blue tories are capable of appreciating reality when it comes and bludgeons them on the head. There are no easy answers to the dilemmas posed by nuclear power. Even. disarmament has a dark side. It sets free nuclear explosives that used to be tucked away in superpotver arsenals, and must now be disposed of

There are various recipes for making nuclear weaponry. Some can be carried out only by experienced master bomb makers. Others are easy enough for beginners to have a go at. All of them, though, contain ingredients—plutonium or highly enriched uranium (HEU)—that have always been very hard to come by.

It is the possession of these nuclear materials, more than know-how about their use, that separates, the Israelis from the Iraqis, or the Indians from the Iranians. Making them is hard, and requires the sort of efforts only rich countries or desperate ones will undertake. Even with money and will, a uranium-enrichment programme takes time to build, and might easily be detected by others. The cost of making materials for nuclear weapons, and the risk of being caught in the act, are the biggest obstacles facing countries tempted to gate-crash the nuclear club.

Mindful of this, countries with nuclear weapons have developed elaborate systems to guard plutonium and HEU. But the authoritarian mechanisms that guarded Soviet nuclear material can no longer be guaranteed. Nuclear smuggling is already on the increase. The number of reported cases rose to over 100 last year, compared with 35 in 1991. So far the contraband is low-grade stuff, from industrial sources, not weapon-grade materials. All the same, smuggling routes are being established that could serve more dangerous trades and customs authorities are beginning to be

> *Nuclear smuggling is already on the increase. The number of reported cases rose to over 100 last year, compared with 35 in 1991. There have already been more than 50 attempts to extort money from America with nuclear threats, some frighteningly credible.*

The mere possibility of a black market in weapon-grade material is terrifying. Instability would spread like a chain reaction. Countries newly unsure about their neighbours' capabilities would find themselvas ever more tempted to try to get a bomb themselves. Terrorist groups, kept from the nuclear game by their lack of industrial infrastructure could become players. Exploiting these fears, nuclear Blackmailers could make a mint. There have already been more than 50 attempts to extort money from America with nuclear threats, some frighteningly credible. The pex>ple who decide whether to believe them or not have been able to check their own stocks quickly, to make sure no bombs or material are missing. Such checks will be less reassuring if the world's supplies become more accessible and, alarmingly, less well documented.

The Soviet syndrome

The break-up of the Soviet Union has fractured the brutal certainties of the cold-war nuclear regime. Roughly 3,000 weapons in Ukraine, Byelorussia and Kazakhstan are now less firmly in the grip of the top brass in Moscow. Ukraine has been reluctant to honour it* pledge to relinquish its arsenal. Whether or not these, countries have nuclear ambitions, there are worries about security on their soil. One Russian officer in reported to have advised his western counterparts to "take seriously" rumours that three or four weapons have disappeared in Kasha kstan.

In Russia itself, the nuclear industry that once supported whole cities, such as Chelyabinsk east of the Urals, and Tomsk and Krasnoyarsk in Siberia, is facing a crisis. Grandiose Soviet schemes for nuclear power have been replaced by Russian realities. Thousands have lost their jobs. The chances of a foreign country finding a Russian engineer ready to sell nuclear advice or materials are growing.

Disarmament treaties between America and the former Soviet Union could further strain the regime for guarding weapons materials. Roughly six tonnes of plutonium and 30 tonnes of HEU are due to be released annually over the next 15 years as Soviet warheads are scrapped. Many western sources believe that there is no reliable overall inventory system to keep track of this material.

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All this is happening against the background of a worldwide accumulation of civilian plutonium. Plutonium is not found naturally on earth, but it is produced whenever uranium is used in a nuclear reactor. Military production reactors are designed to burn fuel in short bursts and thus maximise the production of a particular isotope of plutonium,^{239}Pu. Civilian reactors, designed to produce power, use their fuel for longer and so produce heavier isotopes, ^{240}Pu and ^{241}Pu. To get the plutonium into a usable form, the fuel has to be "reprocessed".

The bombs in today's stockpiles contain almost pure ^{239}Pu. The other isotopes mess up the workings of the nuclear reaction. But isotopically impure plutonium produced in civil reactors can be made into bombs; American scientists at Los Alamos National Laboratory have tried it, and it worked. According to Frank Barnaby, once director of the Stockholm International Peace Research Institute,'it takes about 35 kg (77 Lb.) of civil plutonium in its oxide form to make a bomb, whereas a mere 5 kg of good military metal will suffice. Despite being larger, bombs made from civil plutonium will have low, unpredictable yields, especially if inexpertly designed and assembled. But terrorists do not need the power, precision and elegance of a high yield weapon that fits on a missile. Low-yield bombs in lorries could serve their purposes, demolishing a fair fraction of a city and spreading fall-out far and wide.

Gelger counter

The first convincingly reasoned inventory of the world's nuclear material was published earlier this year. Working from a variety of sources, public and private, the authors conclude that there are roughly 1,000 tonnes of plutonium and 1,500 tonnes of HEU. Because of the doubt attached to their estimates, they want all governments to publish their inventories and submit them to international supervision.

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At the moment, international supervision is woefully limited. Only *1%* of the world's HEU comes under the safeguards administered by the International Atomic Energy Agency, that is mostly used to power small research reactors in countries that have no nuclear weapons. Almost all the rest, 95% of the total, is held by the American and Russian armed forces. It is not all in weapons; as much as 100 tonnes of Russian HEU is used simply to power ships and submarines. A tiny fraction of this amount could be the basis for a successful third-world weapons programme. A mere 130-220 kg of HEU, accumulated in its own enrichment programme, has made Pakistan a nuclear power. This is 0.01% of the world's total stock.

By contrast, most of the world's 1,000 tonnes of plutonium are in civilian hands-though only 30%, that in Britain, France and the non-nuclear states, is under international safeguards. More than half of this plutonium is sitting in used fuel-rods from commercial reactors, unusable for anything until it is reprocessed. But stocks of civil plutonium are flowing forth from reprocessing plants ordered during the 1970s. These plants were supposed to'provide fuel for a new generation of "fast" reactors which would burn plutonium, but neither the demand for nuclear power nor the performance of fast reactops has met the planners' expectations, and the cost of uranium fuel has dropped. Most of the reprocessed civil plutonium-7 2 tonnes-is sitting in storage.

And yet reprocessing will continue. Billion-dollar reprocessing plants have been built in Britain and France. It is hard to resist the pressure to use them, especially as some nuclear-power generators have tied themselves into long-term reprocessing contracts. When they did so, they hoped that reprocessing could cut the cost of disposing of nuclear waste. That claim has not been borne out for today's designs, but such contracts cannot easily be broken. So on current plans the reprocessing plants will separate an average of 21 tonnes of plutonium a year over the next 20 years. By 2010 a total of 545 tonnes of plutonium is due to have been separated. Most of this plutonium will be produced in Britain and France, though some could also be separated in Russia and possibly Japan.

When it comes to military plutonium, America and the former Soviet Union have the lion's share: some 250 tonnes between them. Again, small amounts can have striking political consequences-witness Israel and India with about 300 kg of plutonium each. Russia and America both say they need no longer make military plutonium. And yet, even as military production stops adding to the total amount of nuclear material in the world, plutonium and HEU from dismantled weapons will add to the stocks.

The danger of disarming

The former Soviet Union has mora bombs to dismantle-at least 33,000 weapons in all. The reason the Russians have so many is that fresh plutonium slowly undergoes radioactive decay, making it unpredictable in warheads. America solves this by recycling old material, chemically extracting impurities, occasionally going so far as to make "ivory" plutonium, almost pure ^{239}Pu. As a rule, the Soviet Union did not refresh its plutonium. Aging weapons simply got put into reserve, replaced by warheads full of plutonium fresh from the reactor.

The differences in design account for some of the differences in safeguards. With most of the Russian plutonium in weapons, either ready for service or held in reserve, control of materials could be maintained by locking up bombs. In America, partly because of more recycling, safeguards depended more on full accounting for the nuclear materials themselves as they passed through the long and complex procedures. A greater distinction between the two systems of safeguards, though, lies in their psychology. The Soviet system, confident in its control over its own people, saw threats coming from outside. In America treacherous and corruptible insiders have always been seen as a potential danger.

The snag with disarmament, for all its other merits, is that it disrupts the established Soviet routine. The chart shows how much plutonium and HEU might be released from warheads if the INF and START disarmament treaties are implemented. Weapons will be broken open and the plutonium and uranium stockpiled or processed. This material will be passed to civilian inventories controlled by Minatom, the ministry of atomic energy; counting bombs will give way to accounting Cor material. There is no systematic connection between, the two inventories. Gosatomnadzor, the regulator which was given responsibility for civil and military materials last June, has been reftused access to some military invehtories.

The great bonfire

The HEU that gets to Minatom can, eventually, be burnt in commercial reactors. Uranium comes in two isotopes, 235U and 238U. It is 235U that releases energy; but 99.28% of natural uranium is 238U. For this natural uranium to be made more potent it must be enriched in 235U, which means sorting through the uranium and discarding some of the 238U. A little enrichment-to a 236U content of 2-6%-is good enough for most reactors, though some can work with unenriched uranium and some research reactors use highly enriched uranium. The HEU in weapons is usually enriched to 94% 235U.

Enrichment is hard, which is why bomb programmes are rare. Reversing it—diluting HEU by adding less enriched uranium—is easy, and America is making it profitable as well. America has agreed to buy Russian HEU diluted for commercial use. It is set to pay $780 a kilogram for material blended to a concentration of 4.4% 236 U, a price competitive with that of enriched fuel. A total of 500 tonnes of HEU will be blended into 15,000 tonnes of fuel, which makes the deal worth $12 billion.

The Uranium Institute, based in London, has calculated that the 816 tonnes of HEU that might be released from American and Soviet disarmament could take the place of 166,000 tonnes of natural uranium, roughly three years' worth of world demand. This is a headache for the world's uranium producers, which are already suffering from depressed uranium prices. For everyone else, though, it is a blessing: once blended, the uranium presents no more threat than any other nuclear fuel It would be no easier to enrich than any other reactor-grade uranium.

If only it were as simple for military plutonium. But the world has a surplus of plutonium, even without extra supplies coming from disarmament. And there is no commercial plutonium-fuel industry equivalent to the uranium-fuel industry into which diluted HEU so neatly feeds.

Many bright and failed ideas looking for a second lease on life-are being put forward as ways of converting weapons' grade plutonium into a form too awkward for the weapon-minded to bother with. One such scheme would mix the plutonium with nasty but useless nuclear waste and seal it in blocks of glass. Most of the rest would help pay for disposing of the plutonium by generating electricity from it while turning it into waste. France has thought about reviving *Superphoenix,* its experimental fast reactor, which was shut down after technical mishaps. General Atomics, based in San Diego, has floated a plan for a $1.5 billion helium-cooled reactor—a novel design it has long wanted to build.

There are other, more radical designs. One is a molten salt reactor. Liquid plutonium is squirted in, waste is siphoned off Scientists at Ios Alamos have suggested using particle beams to help burn up the plutonium, rather than relying entirely on particles given off by a chain reaction going on within the material; they think it would be like holding a flame underneath the plutonium, rather than starting a dangerous plutonium blaze.

A study of different ways to burn up plutonium by America's Lawrence Livermore National Laboratory came out against such cleverness, at least as far as using up America's surplus plutonium is concerned (though it did recommend more research into a few). Not only would these novel reactors take too long to develop, but the electricity that comes from them will, in most cases, be needlessly expensive. Instead the study

prefers a proven technology known as mixed-oxide fuel, or MOX,

The idea is to take plutonium and mix it with unenriched uranium. Since ^{239}Pu acts like ^{235}UJ, the end result is quite like the low-enriched uranium used as reactor fuel. The idea dates from the 1950s, when' it looked as if there would be plutonium left over from the fast-breeder reactors that were being planned—reactors which could produce more plutonium than they consumed. Under such conditions MOX made sense. If you have to pay to reprocess the plutonium from spent fuel, though, it does not. An OECD study in 1989 found it unlikely that MOX could compete with uranium under realistic circumstances. According to the fuel-cycle manager of a large German power company, it is twice as expensive as uranium. Even with free plutonium, MOX is unlikely to be cheaper than making uranium fuel from scratch unless uranium prices soar. Some MOX fuel has been made—the lack of an economic rationale has never stopped the nuclear industry trying things—but as yet it has used up only 12.5 tonnes of plutonium.

Now disarmament and reprocessing are bringing about what fast reactors never did: surplus plutonium. MOX would be a relatively safe way of disposing of the stuff. Moreover the Livermore study concluded that it would be easy to adapt designs for tomorrow's reactors so they could burn MOX exclusively—rather than a mixture, one-third MOX and two-thirds uranium, as is the practice today. Given free plutonium, the report says that such a plant could generate electricity at 3.1 cents a kilowatt hour (kwh), compared with 3.0 cents a kwh using uranium fuel in a standard reactor.

> ***"The lack of an economic rationale has never stopped the nuclear industry trying things"***

Unfortunately there is not enough capacity in MOX factories to turn the weapons surplus from both superpowers into fuel. And governments have not licensed enough MOX-burning reactors to absorb the plutonium coming from reprocessing plants, let alone tonnes of weapon-grade plutonium as well. According to the authors of the inventory, even the most optimistic projection — which, incidentally, takes no account of military plutonium — sees plutonium stocks growing from 72 tonnes in 1990 to 113 tonnes in 2000, before decreasing to 36 tonnes in 2010, as MOX fabrication and fast reactors take off.

•

As a matter of course, many will protest about shipping and flying civilian plutonium around the world in large volumes. Terrorists will not be among them. Some of the planned M@X factories will probably fail to get approval; reactors will be refused licences to load MOX into their cores. In Germany and Japan, where reprocessing nuclear waste'has been a requirement, using the plutonium **produced seems lees popular, several utilities are having difficulty securing licences to burn MOX. A projection that tries to take account of some of these factors sees civil plutonium stocks growing to 265 tonnes by 2010.**

The commodity from hell

The problem is not just that MOX reactors provide only a narrow channel for disposing of military plutonium, or that the channel will be clogged by the plutonium from uneconomic civil reprocessing programmes. It is that these programmes, and the plutonium economy they seek to bring into being, encourage the Russian nuclear industry to think of plutonium as valuable. Far from talking of the plutonium problem, desperate Russian nuclear engineers, encouraged by the plutonium industry in France and Britain, want to begin a new programme to build fast reactors running on plutonium, undaunted by difficulties the West has had with such technology.

Even if it were technically possible, Russia does not have the money to do it. The alternative, when plutonium is seen as a fuel, is to load it into existing Russian reactors, unused to the stuff and already regarded as unsafe by outsiders. Either way, as long as reprocessing plants make plutonium look like a commodity, the risk that the wrong people will buy it remains.

The Economist June 5,1993

! Letter Box

so great as to counter balance the great danger of radiation. If not, why take all this risk,

R. K. Patill
Civil lines
Nagpur

The article presented in **the** special issue on Rawatbhata (April/May 1993) is **systematic,** authentic and full of information- However, **I feel that no definite** conclusions can **be drawn on the** basis of **the survey observations.** What **the survey does is to provide**

August / September
1993

a foundation oft the basis of which further studies can be initiated. Simultaneously, efforts can be started for the control and treatment of those diseases in which in* creases are seen.

As the survey showed, the incidence of diseases is greater in the proximate area. A deeper study of congenital deformities, skin diseases and solid tumours could be extremely useful. For such a study it is essential that the doctor be in constant touch with the- community. Cause-effect relationships can be established only when field experiences are examined in the spirit of research.

New conditions of existence are causing various kinds of effects. There have been changes galore in psychology, living conditions, food habits, types of work, standards of what is considered good or bad, status symbols, etc. As a result of these changes, the extent of diseases have been increasing and the disease pattern has been changing. We have not found any correlation between the the availability of health services and a decrease in ill-health. Today's health care system is commercial. Patients too equate more expensive treatment, immediate relief, absence of restraints on diet, with better treatment, This means far too many variables and makes the task of analysis all the more difficult. The effort at analysis can be put in but only if the sufferers cooperate.

A great deal of glitter is associated with large projects. People want to be associated with 'new' schemes. They try to maximise their 'profits'. The spirit of sacrifice for larger benefit of the society is lacking. We too live in an area which is affected by a host of large projects. Every day new health problems occur. Change is taking place so fast that there is no time for reflection and analysis.

Or Rogini Piem
Banvasi Seva Ashiom
Govindput Dist Sonbhadra U P

I do not wish to continue my subscription for *Anumukti* henceforth. I can understand the safeguards against nuclear follies. But to accept absolutely non-nuclear India appears to be a very retrograde step. The whole Narmada Bachao movement has revealed to me the most nauseating aspect of the parochial anti-Gujarat, movement of the so-called objective people. Sharad Pawar said the other day, "if any body stops me from building dams on Krishna river I will not tolerate it." Pray, why single out Gujarat? We want to preserve tribal music and poetry but not their hellish lifestyle.

Meghnod Shalt
3 Sahokui
Jelly Gully Andher Bomboy

The Rawatbhata special issue (April/May 1993) was done very well indeed! As 1 am a fairly new member, may I suggest that you enclose a rough map of all Nuclear installations in India with a short not on each. When each was installed and how they are running and how much/little they benefit those that they were supposed to benefit and the destruction they have caused to the environment. This will give one a bird's eye view and be the basis for our strong protests against them. I trust I am not asking for the impossible, but 1 would like to have something concise to show people who, through facts and figures, understand the irreversible damage these nuclear installations are creating.

Pareen Iakako
Avasa House. Darbash one
Bombay

Abolish The IAEA

Anumukti* strongly endorses the stand taken by War & Peace Digest and** *Anti-Atom-International regarding the* ***IAEA and we urge our readers to send letters to politicians asking *for reform* ***in the*** *structure and functioning of* ***this United Nations' agency***

Of all the anachronisms still abroad in the world few have such dangerous consequences as the International Atomic Energy Agency **(IAEA).**

Following the trauma of the bombing of Hiroshima and Nagasaki, the **nuclear establishment sought to redeem the atom by promising a cornucopia of civilian benefits in medicine, food preservation and "energy too cheap to meter." This** was **the "Atoms for Peace" program. And of course, the nuclear industry urged the development of bigger and letter" bombs to make the world safe from** war.

It was **in the spirit of such gung-ho nuclear enthusiasm that the In**ternational Atomic **Energy Agency (IAEA)** was **founded in 1967, enjoying a 'special relationship' with the United Nations, and committed to the active promotion of nuclear power in all its forms. It was the only U.N. organization committed to the promotion of a particular energy system. Its annual $186-million budget is derived from 112 supporting governments.**

APPEAL FROM AUSTRIA

W ıp-s for a reform of the IAEA as described below:

Since 1957, when the IAEA was established, the world and its view of nuclear energy has changed. It is time for a change of the IAEA's function, too. The IAEA should become a purely nuclear control organization without any promotional function.

Nuclear power cannot solve world's energy problems. Therefore a "United Nations Agency" for the promotion of nuclear power is obsolete and counterproductive. In this sense, the articles 2 and 3 of the IAEA's statute have to be changed.

The use of nuclear energy for peaceful purposes and the development of atomic bombs are inseparable. The spread of peaceful nuclear technology led to the proliferation of atomic weapons technology.

The NPT was an attempt to stop this development, but it failed because of the limitations in the safeguards regime. In 1995, the parties of the NPT have to decide whether to extend the NPT or not. we think the NPT should be extended - but not without changes.

The NPT should become an effective instrument of nuclear disarmament and non-proliferation:

Establishing of the IAEA as an organization for the effective and comprehensive . control of fissile material—both civilian and military—and extension of its related possibilities and competentions for radiation protection and waste management!

The application of safeguards to all states without discrimination.

D rticle 4 NPT. (Promotion of atomic energy for peaceful applications and promotion of peaceful nuclear explosions.)

A complete nuclear test ban treaty.

Stop all civilian and military production of plutonium.

The IAEA's "technical assistance" and "technical co-operation" are promotion programmes for the application of radioisotopes and radiation for industrial, medical, agricultural and other purposes in developing countries. One main reason for this policy has been and still is to give a positive image to a technology which from the very beginning has been connected with death and devastation.

Most of the IAEA's promotion has been given to large-scale projects (e.g. food irradiation). These projects are fequently not adapted to the specific needs of developing countries.

To avoid unnecessary applications of nuclear technology in industry, agriculture and medicine, the United Nations should promote the research on, and the development and application of non-nuclear alternatives.

No further nuclear application in industry, agriculture and medicine without proof of requirements and without proof of non-nuclear options!

No application of nuclear technology withoutepropriate regulations for radiation protection and waste management!

Nuclear power is a hazard to environment and people. Therefore it has to be stopped as soon as possible. Until this aim is reached the IAEA should:

Improve the safety of existing nuclear power plants and other facilities of the fuel cycle!

I mprove ___ protection _ _________ workers,environment and the public!

Develop solutions for the problems nuclear industry has created: especially for the radioactive waste!

Minimize and avoid transports of nuclear material and waste!

To accelerate the phasing out of nuclear power production the United Nations should:

promote the research on, and the development and application of renewable energies, especially in small-scale installations.

take suitable action to cut down the waste of energy, especially in the industrialized countries.

The IAEA's work has to become more transparent:

NGOs have to be allowed to participate in conferences and in the LAEA's missions. Full information has to be provided for the affected people. To finance this work of NGOs an appropriate part of the countries' contribution to the IAEA budget has to be used.

Now, despite the overwhelming evidence of millions of premature deaths from massive global con tamination by nuclear radiation, despite the continuing deaths and illnesses from the accidents at Three Mile Island and Chernobyl, despite the still-unsolved problems of disposing of vast and rapidly accumulating nuclear wastes that will remain lethal for thousands of years, despite all this, the IAEA continues to act as a propaganda and promotion agency for the nuclear industry.

We suggest abolition of the IAEA The work of rigorously monitoring the nuclear fuel cycle—from the mining of uranium to the dismantling and disposal of nuclear weapons and nuclear reactors—could be transferred to an independent United Nations scientific authority with no attachment to the nuclear industry. And the urgent task of developing alternative, non-nuclear, non-polluting, safe and renewable energy sources should be undertaken by a completely new international U.N.

cy (IAEA) is located in Vienna. Arguing with IAEA's policy of promotion of nuclear technology is an important part of AAI's work.

Anti - Atom - International has recently published a study which documents the role played by the International Atomic Energy Agencyf which is a UN agency, in spreading the ha sards connected with the use of nicelar energy throughout the world. They consider reform of the agency a priority for antinuclear and environmental groups. They feel that efforts to reform organisations such as IAEA can only be successfill if political pressure is brought upon the organisation from many people and many countries. It is in this connection that they have issued the following appeal. They want that as a first step, people should write to their own governments.

Anti Atom International
A-1010 Vienna Austria

Protest In Taiwan

Pol lowing weeks of intense and occasionally violent debate the Legisrcided on July 9 not to review or freeze last year's initial budget for construction of Taiwan's fourth nuclear plant. The decision will allow the construction bidding process to continue. The Taiwan Power Company (Taipower) is to select the construction contractor by the end of this year.

The July 9 open-ballot vote was the second vote in three weeks of bitterly divided and often chaotic debate both in and outside the legislature. The issue was initially debated and voted upon on June 23 by the Legislature's Budget, Economic, Interior Affairs and National Defense Committees. The legitimacy of that vote, which was held in an uproar after hundreds of protesters stormed into the Legislature's meeting hall, was disputed vehemently by legislators of the opposition Democratic Progressive Party (DPP). The opposition forced the ruling party to submit the issue to an open ballot of the full legislature on July 9. The final tally in the voting was 76 to 57 opposed to reviewing last years passage of the budget. In other words, the budget will stand and the project will continue for at least one more year.

Demonstrators from anti-nuclear groups and the Yen Liao area where the nuclear plant is to be built had been camped outside the legislature building in downtown Taipei in protest since early June. By June 23, their numbers had swelled to over a thousand During the afternoon discussions, the Yen Liao protesters stormed through police barricades and broke down the doors of the Legislature Building to get into the meeting hall Chaos ensued in the packed hall and continued during the voting. A scuffle between two legislators over the voting process ended with both in the hospital. When the legislature reconvened two days later, supporters of the two inyured lawmakers clashed outside the hall as legislators inside argued the validity of the previous meeting's vote count and committee process.

The outcome of the votes reflects the control the ruling party (the Kuomirtfang, or KMT) still maintains over the legislative process. As the decision approached, the KMT leadership devoted their full efforts to supporting Taipower'e plan to build the no. 4 plant. On July 7, President Lee Teng-hui, who also is chairman of the KMT, warned that any KMT legislator who voted in opposition to the fourth nuclear plant would be punished by the party. (Even so, three KMT legislators voted against the project.)

The debate which was raging in the media and society on the need and consequences of building a fourth nuclear plant was rendered irrelevant by the KMT's pressuring of its legislators. The public debate was turned into a purely political issue in which the majority party held control, and the public's doubts about nuclear power had no impact on the decision.

The focus of anti-nuclear groups turns toward next year, when the budget will again be up for review. If there is no visible improvement in Taipower's safety management, opposition to the fourth nuclear plant project is likely to grow even stronger. Many observers are predicting annual clashes over the budget as long as the project exists. If a contract is signed with a bidder this year, however, blocking the project may be more difficult in the future.

On the positive side, the debate over nuclear power escalated to a level never before seen in Taiwan. Opposition to building another nuclear plant has grown in force with every scram and accident at the nuclear plants. The media's standpoint has been increasingly skeptical of nuclear power. And had the KMT not exerted strong pressure on its legislators, the opposition would likely have succeeded in freezing the project's budget. There is hope!

The media in Taiwan, responding to the unceasing string of incidents at the nuclear plants, began reporting on nuclear issues with greater frankness and skepticism than ever before. In the legislature itself, the opposition parties formed a solid bloc to force freezing of the budget, and a few legislators of the ruling Kuomintang (KMT) party even dared to risk the wrath of their party by not supporting the fourth nuclear plant project.

Nuclear Report from Taiwan
July/August 1993

STAR WARS: 1983-1993

A $30 BILLION LESSON

The tragedy was that the Czar could lift a finger, touch a bell and ignite a war without consulting any living person.

Alexander Kinglake 1896 - War in the Crimea

One night in 1983, without warning, thout cabinet approval, without a word to the United States Congress or the United Nations, without consultation with the world science community, without notification of any other nation, without even informing the Pentagon or the military chiefs of staff, and without the slightest reflection on the implications, Ronald Reagan off-handedly announced that he wanted to put nuclear bombs in space.

Thus was born Star Wars. SDI Reagan called it. Strategic Defense Initiative. "Some Dumb Idea" commented Admiral Gene LeRoque of the invaluable Center for Defense Information. Former Defense Secretary, Harold Brown said it was "the most irresponsible act by any president this century".

Here was a proposal that would be horrendously expensive, destabilize all existing military understandings, violate the ABM Treaty, initiate a nuclear arms race in space, jeopardize the entire international civilian space enterprise, create a system that could be destroyed by cheap and easy countermeasures, and, even in the unlikely possibility that it could ever be even marginally effective, would, to that extent, simply en*courage adversaries to take the bombs off the rockets and smuggle them into potential target nations. Carl Sagan wryly suggested bombs might be hidden in "all those bales of maryuana that seeto to have no trouble getting past customs." From the beginning the whole idea was impossible, inane, ineffective and counterproductive.

Nevertheless, despite relentless criticism from some of the nation's leading science minds, despite untiring efforts by the Union of Con-

cerned Scientists, and citizen's activist organizations like 1SCOS (Institute for Security and Cooperation in Outer Space), Star Ware would, in the next ten years, soak up $30 billion of taxpayers money to produce nothing but a destructively costly embarrassment. It has now finally been ended by President Clinton.

There are painful and difficult lessons to be learned from the Star Wars blunder — and there is much blame to be shared by many.

Reagan, of course, started the madness when this most intellectually defenseless of presidents was effortlessly bamboozled at dinner one night by that slyest of corrupt scientists, Edward Teller, who went on to profit handsomely from Star Wars contracts and to siphon off billions of tax dollars for his Lawrence Livermore Radiation Laboratories to play with.

But how was Reagan allowed to proceed so far so fast with so preposterous a scheme?

Thousands of scientists who should have known better—indeed, who did know better—nevertheless dived into the apparently bottomless trough of public funds for all manner of crazed schemes—orbiting X-ray Lasers powered by nuclear bombs!—things they knew could not and would not work, but could eat up literally trillions of dollars in pointless research. Despite the heroic efforts of a minority to halt the project, many scientists and the science community as a whole have lost much respect by this disgraceful display of greed and dishonesty.

The fact that, year after year, with virtually no discussion, Congress meekly caved in and voted for huge allocations for Star Wart* reflects ill on the collective level of intelligence, judgment and integrity of the members of both houses. Including alas, then Senator Al Gore, who unfailingly supported the scheme.

The mainstream media has largely let the outrage of Star Wars slip by with the same sort of lazy, indifferent and shallow reporting they displayed in the other Reagan-Bush scandals.

But sadly, people probably do get the government they deserve. The fact is there was virtually no spontaneous or organized public outcry. It is an unflattering reflection of American citizens. There seems to be truth in the observation by Robert Hughes in his jurrent bestseller, *Culture of Complaint*, that "Reagan educated America down to his level. He left his country a little stupider in 1988 than it had been in 1980."

So what are the lessons?

It seems that there is neecl for some corrective legislation. It make* no sense that so vast a change in the military policy and weaponry of the world's most powerful nation can be determined by a mere passing whim of a notoriously ignorant and ill in* formed president. Nor has the threat ended. There is no guarantee that, next year or next century, some unforeseen exigencies of economics, politics or society will not again throw up another president like Reagan.

Work therefore should begin immediately on devising some more orderly legislative procedures by which monumental undertakings like Star Wars can first be held up to public scrutiny and debate—in the USA and in the United Nations—before such dangerous and extravagant fantasies are set in motion to so willfully and pointlessly plunder the public purse again.

But at least, for now, the slow death of Star Wars has begun; thus, as ISOOS President Carol Rosin, has pointed out, depriving the generals of their last, desperate justification to resume nuclear testing.

Letter from Kakrapar

Of all the nuclear power plants in the world, for us in South Gujarat, Kakrapar is the one that gives us the most nightmares. Its proximity overwhelms everything else.

It is not that the plant is very old and suffering from all the various kinds of problems like neutron induced brittleness and bacterial corrosion that beset old reactors like the one at Tarapur. In fact, the reactor at Kakrapar is brand new. It has yet to celebrate its first birthday. Yet on July 31st it had an unplanned shutdown. Another Rs. 50 million down the drain. Or is it Rs. 100 million? Who knows and who cares!

Just a month ago, the Atomic Energy Regulatory Board (AERB) had announced with much fanfare that following the report of the inquiry committee investigating the cause of the devastating fire at Norora Atomic Power Station on March 31, 1993, all the nuclear power plants in the country were to be closed down for inspection.

Quite a few newspapers wrote editorials congratulating the AERB for having come of age and having grown (at long last) a set of teeth. Alas, AERB has been toothless for so long that it hah now no idea what teeth are meant for. One would have expected that this sudden unplanned shutdown at Kakrapar would be a fine opportunity for AERB to thoroughly inspect the reactor. Such an inspection is all the more necessary since in the first place the AERB allowed the reactor to start without properly checking if vital safety systems like the Emergency Core Cooling System were functioning as per design intent. But no inspection was undertaken and the reactor was restarted on 6th of August to commemorate Hiroshima Day.

You wouldn't think of it but Hiroshima Day is something 'special' at Kakrapar. On 6th of August in 1086 police fired on a large rally of protesters killing one young boy and injuring another. Ever since, every Hiroshima Day we witness a huge contingent of police drawn from various districts of Gujarat patrolling the villages. Of course, most people prefer to remain indoors, in order to avoid any sort of provocation. Although for the last five years there has been not even a hint of protest, the police have stuck to their vigil. The beginning of June brings monsoon showers and the beginning of August brings police interrogators.

At the time construction of Kakrapar project began some were happy that this project would 'improve' their employment prospects. However, after working for a little while in the plant complex many are beginning to have doubts. There have been persistent reports of mysterious disappearances. One worker in the operations and maintenance section who was working on elevator number 112, became unconscious. There was a rumor that he received 3,000 millirem of radiation dose in half an hour. People tried to revive him, but they seemed afraid to touch him. Finally he was sent to Bombay. Three months have passed and there is still no news of him.

Coming back to the unplanned shutdown of July 31. The authorities told a correspondent from *Sandeah* (a Gujarati newspaper) that the shutdown had been due to large vibrations in the turbine blades. The bearings had worn out and had become loose they claimed. These had been replaced by a new packing and now all was hunky-dory. Though it is beyond understanding how bearings could have worn out in less than a year.

Some have definitely benefited from Kakrapar at least in monetary terms. The Mandvi Education Society, which runs the Mandvi High School is one such. On 27th of August they received a 'donation' of Rs 200,000. Last year they had .received a donation of Rs 500,000. No doubt there will be more donations to worthy causes in the future as well. **Some** uncharitable antinukes have dubbed these donations as 'blood money'. They claim that Mandvi High School which is within 5 km of the atomic power station is jeopardizing the future health of its students. •

Some other schools have decided to play it safe. The school **at** Vanskui run by the Gram Seva Samaj an organization associated **with** Shri Jhinabhai **Darji has already shifted premises and** relocated outside **the** 5 km **zone.** They deserve congratulations for their sense of responsibility towards their students. Other schools are also considering shifting to newer distant sites. They ought to be helped by the government in this eminently sensible move. Similarly the government should help other residents in the vicinity of Kakrapar to relocate.

Surendra Gadekar

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ANUMUKTI

A Journal Devoted to Non-Nuclear India

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Awards

The beginning of the year is usually considered to be a fit time for announcing of awards commemorating significant actions during the past year. For once, *Anumukti* joins the bandwagon.

National Gratitude Award for the most significant action by members of the nuclear community:

- *Shift operators at Narora Nuclear Power Plant*

On the night of 31st March, 1993, it was their quick thinking and decisive action in utilising the fire engines which had come to put out the raging fire at the turbine room of the plant to instead drive the secondary pumps and cool the reactor, that avoided a major nuclear catastrophe in one of the most densely populated regions of the country.

Nucleocrat of the Year Award for the best action by an official of the nuclear establishment:

- *Dr A Gopalakrishnan (Chairman, Atomic Energy Regulatory Board)*

for his initiative in trying to impose some form of control and regulation over the proliferating X-ray clinics all over the country This is a long overdue action and *Anumukti* can only applaud this initiative to reduce excess radiation dose received by the patients, radiographers, doctors, onlookers and the general public, (see story next page) If only Dr Gopalakrishnan can summon the same initiative and curb the excessive radiation emissions from nuclear facilities.

The Nukespeak Award for the most outrageous statement by a nucleocrat:

- *1. Dr R Chidambaram (Chairman, Atomic Energy Commission)*

There has been no accident of any kind in nuclear stations in India and no radiation injuries have occurred at any time." (P77Bhubaneshwar 7.9. 1993)

- *2. Dr R Chidambaram*

"We don't dump nuclear waste anywhere. We immobilise it." (*PTI* Bhubaneshwar September 7,1993)

- *3. Dr R Chidambaram*

"No harm will be done even if the radioactive sources remain in water and slush of the Cooum for a thousand years. (The Hindu October 22,1993)

All these statements are breathtakingly outrageous. They confirm to the 'high' standards of nukespeak set by such illustrious predecessors as Dr Raja Ramanna and Dr P K Iyengar. One can only admire a person who has such a well developed case of foot in the mouth disease. No other nucleocrat came anywhere near Dr Chidambaram's exalted level on the nukespeak scale.

Never Too Late For Realism Award:

- *1. Dr R Chidambaram*

"The spent nuclear fuel lying at Tarapur can cause radiation hazards. Indefinite storage is certainly a problem". *(The Telegraph: 20.12/93)*

- *2. Mr D. V. Gopinath Director of health, safety and environment group at Bhabha Atomic Research Centre*

"Emergency situations beyond the design basis of nuclear power plants cannot be ruled out. There is need for implementing a comprehensive preparedness plan." *(Times of India 11.9.1993)*

From the Editor's Desk

Every year, come October November, I start getting a bit nervous. This is Diwali time and the time when my printer takes a long holiday. Besides, during Diwali there is a very heavy rush for printing jobs. Almost every year for the last five years the October/November issue gets delayed and that makes for a backlog which takes a long time and effort to clear.

But this year, I was sitting pretty. Most of the work had already been done and there were just one or two little things that I wanted to change. Diwali was still a while away and I felt sure that now with modem technology like fast computers and all available at Vedchhi, this was the year that Anumukti finally would start sticking to schedule.

And then there was literally a bolt from the blue. As I was giving the final touches, a surge of lightening struck near the house and the computer took off into orbit. Recovery was painfully slow and when finally the hardware was replaced there appeared a virus in the software which took even longer to repair. I learnt a lot about computers and computer viruses, but *Anumukti* remained in the limbo. Today is 5th of February, 1994 and I can only say Happy New Year and wonder whether these modern 'time-saving' gadgets really do save time. Someone rightly said, "Either you work with people or you work with machines. People give trouble and are unreliable but machines are a whole lot worse."

India to initiate X-ray Controls

India's Atomic Energy Regulatory Board (AERB), which produces guidelines on radiation safety, is to review the operating conditions of medical radiography equipment and to update the guidance it issued in 1989. The board has announced a nationwide regulation programme under which all existing radiography units will be registered, reviewed for radiation safety, and subjected to stringent controls. The programme is designed to eliminate what officials from the board say are unsafe practices that could be jeopardising the health of patients as well as staff.

India has about 50,000 medical radiography units, and about 1,500 new machines are set up each year. Radiographic diagnosis is very popular and patients sometimes demand x-ray examination.

The board has evidence that some radiography machines have faulty diaphragms and improperly oriented primary beams. Protective accessories like gonadal shields and lead aprons are not used in many units, according to the board.

"Although radiation safety authorities offer personnel monitoring services, x ray units are unfortunately reluctant to use them", said a senior official from the board. Studies conducted by the board have shown that some patients might be receiving 50—200% excessive exposure.

The board has also expressed concern over poorly trained radiography staff. It says that private institutions with neither adequate equipment nor qualified trainers have cropped up and offer very short courses in radiography. Those trained in such institutions find jobs in many of India's privately owned units and hospitals.

Many doctors share the board's concerns. "In this business there are probably more unqualified people than adequately trained radiographers," said Dr Rajjnder Nath Bagga, secretary of the Indian Radiology and Imaging Association, which represents some 2000 radiologists.

The new initiative will make periodic quality assurance tests of all radiography machines mandatory. The board and the radiologists' association also plan to conduct joint training programmes for staff in radiography units.

Gurunandan, science writer, New Delhi; British Medical Journal 30.10.1993

Hiroshima's shadow over Sellafield

Sellafield is the site where Britain began its quest for the A-Bomb. Today it is the heart of nuclear Britain with large reprocessing plants. The thermal oxide plant (THORP) located there was recently allowed to start operations by the government, although antinuclear groups have vowed to take the matter up in the European Court of Justice. Sellafield or Windscale as it was previously known has become a byword for nuclear contamination. The Irish Sea near Sellafield is the most contaminated sea in the world and there have been many reports of excess childhood leaukaemia cases in the immediate neighbourhood of the plant. In 1990 Or Martin Gardner of the Southampton University, published a paper which showed that the chances of leaukaemia in children were significantly enhanced if their fathers had worked in the plant and had received radiation (well within the 'acceptable' limits) during a period six months prior to conception. (See Anumukti Vol.3 No.3) Recently, a case was brought against British Nuclear Fuels (BNFL) the owners of the plant by two of the victims. This is the first of three articles which outline the major arguments on both sides, the variety of health problems encountered in the area and the difficulties in taking a major industry like nuclear power to court.

A 11 pm on 8 October, the final curtain came down on Hope and Reay vs British Nuclear Fuels, so ending one of the longest suits in the history of British civil law. The "Sellafield cancers case", as it was dubbed by the nation's headline writers, had all the makings of classic legal drama-allegations about radioactivity and genetic damage, families of children with cancer seeking compensation, a large and powerful industry in the dock. The case also threatened to break new legal ground. For the first time a British court was being asked to rule on personal injury claims based on alleged genetic damage from radiation. Victory would throw the doors wide open for other Sellafield familes to sue.

At issue was whether the cancers suffered by Vivien Hope and Dorothy Reay—the daughters of lifelong employees of British Nuclear Fuels (BNFL)—could be blamed on radiation damage to their father's sperm at BNFL's nuclear reprocessing plant at Sellafield. But as the hearing unfolded it soon became clear that Sellafield's safety was not the only thing on trial. Also in the dock was the competence of science, specifically its ability to judge the risks of radiation to reproductive cells. Could exposure to relatively low doses cause genetic defects to be passed on to children through damaged sperm?

Expert witnesses flew in from across the globe and for 90 days scientists and lawyers grappled with a mass of semingly conflicting findings. Half this time was devoted to discussing epidemiological research into the possible links between radiatiorfexposure to adults and cancers in their children. And in this crucial part of the hearing the court examined some 15 different studies. Finally, the debate about these studies boiled down to a duel between two opposing pieces of research.

The plaintiffs' hopes were pinned largely on a controversial British study by the late Martin Gardner, professor of medical statistics at the University of Southampton. Three years ago, Gardner claimed to have found a statistical link between the incidence of leukaemia and non-Hodgkin's lymphoma in children born to men employed at Sellafield and the amount of radiation the men had been exposed to before their children had been concieved. Pitted against his research in court were results from the largest and most influential of all studies of the genetic effects of radiation—the huge follow-up study of survivors of the atomic bomb blasts in Hiroshima and Nagasaki in 1945. This study, as BNFL's lawyers eagerly pointed out, found no excess of cancers of genetic defects in the children of survivors who had been exposed to radiation.

When the hearing ended, the ruling ran to more than 200 pages. Yet the essence of the judgment was simple enough: in the debate about epidemiology, the negative findings from the atomic bomb study were deemed more convincing than Gardner's positive findings BNFL cleared, was the tone of most newspaper headlines. **But despite this result, the** courtroom **debate had** succeeded in exposing **potential complications with the atomic bomb research which have never before** been aired in public.

Atomic Bomb Survivor Studies

The genetic studies on the children of atomic bomb survivors began in the spring of **1948, and were led for many years by Jim Neel and Jack Schull Neel. now at the University of Michigan Medical School, Ann Arbor, became acting director of field studies for the Atomic Bomb Casualty Commission in Hiroshima in 1947. Two years**

later he was joined by Schull, now at the University of Texas. The Radiation Effects Research Foundation (RERF) succeeded the ABCC at Hiroshima.

From the outset of the case, the results from the ABCC and RERF posed a major stumbling block to the Hope and Reay families. In more than forty years of research, Neel, Schull and their colleagues have failed to uncover any convincing evidence of an excess of harmful genetic mutations in children whose parents had been exposed to atomic bombs. This is despite the fact that they have looked at as many as 75,000 such children, and that the average exposure to radiation at Hiroshima and Nagasaki was higher than that for Sellafield workers.

Gardner's Results

The contrast with Gardner's results couldn't be greater. In 1990, he and his colleagues published a paper in the British Medical Journal claiming that children born to Sellafield workers who had previously been exposed to a cumulative dose of more than 100 millisieverts of radiation—twice the maximum annual dose at present allowed under British law- were eight times more likely than other children to develop leukaemia or non-Hodgkin's lymphoma.

Gardner believed that the discrepancy between his study and the Japanese data could best be explained either by differences in radiation dose rates—a sharp blast in the case of the atomic bombs versus chronic exposure to low levels at Sellafield—or else by differences in the average intervals between expoure and conception. Both these points were important to the plaintiffs' case. But, in addition, the plaintiffs' lawyers tried to expose weaknesses in the ABCC and RERF study.

Bizarre paradox

Part of their approach was to focus on what seems to be a bizarre paradox in the Japanese data: namely, that children born to atomic bomb survivors appear from these data to be healthier than children of the same age born in Japan as a whole. And not by a trivial margin either. Stillbirths were down 85 per cent, deaths from cancer by 20 per cent, overall mortality by 30 per cent and infant mortality (from all causes) by 35 per cent. So counterintuitive are these findings, argued Eva Alberman, a reproductive epidemiologist at St Bartholomew's Hospital in London and a key witness for the plaintiffs, that they can mean only one thing: the researchers must have inadvertently failed to identify all the deaths and genetic deformities in children of survivors who had been exposed to radiation. It was either that, or the bombs had conferred some beneficial effect—which "seems crazy". This was robustly denied in court by Neel and Schull, who said the beneficial effect was either statistically insignificant or the product of terminology differences.

The most likely explanation for the apparantly crazy finding in the ABCC study:—The children born to atomic bomb survivors appear from the studies to be healthier, than those born in the rest of Japan— is that the study failed to diagnose all cases of congenital problems.

Testifying in court, Alberman highlighted two apparent inconsistencies in the Japanese data. First, she said, the reported incidence of Down's syndrome among children born to survivors was half what would be expected on the basis of statistics from other countries; and secondly, Down's syndrome was twice as prevalent in the children of suvivors classified as "not exposed" as it was in children of "exposed" survivors. Neel and Schull's explanation is that, on statistical grounds, the rates are too unreliable to compare in that way. But Alberman believes the most likely explanation is that the ABCC study failed to diagnose all cases of Down's syndrome. And if that is so, she says, perhaps other congenital conditions had been underdiagnosed. According to the ABCC's figures, about 1 in 100 babies conceived by atomic bomb survivors between 1948 and 1954 were diagnosed as having a major congenital deformity such as hydrocephalus, spina bifida and polydactyl. The comparable figure for Britain in 1958 was 1.7 in 100.

In the early years after the bombs, Alberman told the court, most Japanese women gave birth at home, attended by midwives who were not trained in diagnosing deformities. Another potential problem might have been deliberate underreporting. Neel's opinion about this seems to have shifted with time. In court he said: "It rapidly became known throughout Hiroshima and Nagasaki that malformation was a possible outcome of exposure to the bomb. This did much to remove the stigma because then you had a causal agent inflicted upon the women. It was a cause she could accept." But in 1958 Neel wrote: "The birth of a malformed child stigmatises the family involved to a greater extent in Japan than in most Western cultures, and it seemed quite possible that the physician-interviewer had not established sufficient rapport with the family to obtain an accurate history. So could the Japanese data have under-, estimated the medical problems suffered by the children of suvivors exposed to radiation? Testifying on behalf of BNFL, Neel and Schull accepted in court that the studies had been difficult to carry out. But they were adamant that their estimates of the genetic risks of radiation exposure were accurate. The main reason for their confidence was that these estimates are based on a comparison of similar groups of children—those bom to people who had been exposed to radiation from the bombs, and those born to people living in or near Nagasaki and Hiroshima who had been exposed to little or no radiation.

The reported rates of stillbirths, congenital deformities, infant mortalities and deaths from cancer are almost identical in these groups of children. And it is this comparison that matters most, say Neel and Schull. Even if the children of atomic bomb survivors seem to have been abnormally healthy compared with children living elsewhere (and this claim was denied in court), the fact that parental exposure to radiation seems to have had little effect in the children's health means only one thing in the eyes of the ABCC researchers: that exposure to radiation failed to damage the reproductive cells of the atomic bomb survivors.

To shatter this assertion, the plaintiffs' lawyers had to try to show that the diagnosis of medical problems may have been uneven in the "exposed" and "unexposed" groups. Could American researchers, for example, have overlooked a disproportionate number of luekaemia cases in the children of the "exposed" groups? This was unlikely, said Neel, because any problems would automatically apply equally to all groups of children in the study.

Yet there was one uncertainty which Neel freely acknowledged in court. Early in their study, the ABCC researchers had to abandon their attempts to gather data on miscarriages in the first five months of pregnancy. It became clear, said Neel, that it was impossible to monitor these losses. This meant that the researchers had to make two assumprtions when calculating the genetic risks of radiation: first, that fetuses were lost for the same reason in "exposed mothers" as in "unexposed mothers"; and secondly, that the rate of loss was the same in all groups.

Because these assumptions are unverifiable, Alberman contends that the ABCC results cannot be used to assess accurately the inheritable risks of radiation exposure. A high proportion of spontaneous abortions in the first few months of pregnancy are thought to result from genetic mutations that affect fetal development, she told the court. And there are at least some grounds for thinking that such mutations might have been more prevalent in the reproductive cells of survivors exposed to high doses of radiation. If Alberman's concerns are justified, then the ABCC's estimates of genetic risk are based on data gathered after the period during which most of the lethal damage from radiation would have been eliminated.

Rocketing Abortions

Another potential source of bias between the "exposed" and "unexposed" groups emerged in court: abortions. All over Japan the abortion rate rocketed after the war. With thousands of people returning from Japan's former colonies, the government decided to make abortion freely available as a form of birth control. One consequence of this policy was that as many pregnancies were deliberately terminated in Hiroshima in 1950 as came to term.

What if a disproportionate number of these abrotions were of fetuses with genetic defects, asked the plaintiffs' lawyers. Might not the high abortion rate then mask some of the harmful effects of radiation? This was unlikely, said Neel. The high abortion rate could only have biased the results if some women chose abortions because they knew they had been exposed and as a result suspected they might be carrying damaged fetuses. Certainly, Schull told the court, there was a great fear among exposed survivors that radiation might cause congenital deformities in children. But there was no evidence that any women survivors had decided to have an abortion for these reasons, he said. Rather, the most commonly acknowledged reason for abortion was poor economic circumstances, according to a study of a small sample of survivors by Schull. But in court Alberman wanted to know why data from Hiroshima showed an increasing trend in abortion with increasing radiation dose.

It is dear from the ruling that the debate about miscarriages and abortions failed to convince the judge that diagnosis of medical problems in the "exposed" and "unexposed" groups of survivors could have been seriously biased. But this still leaves a paradox unexplained: why did the children bom in both groups appear to be healthier than those born elsewhere in Japan or in other countries? Why were the rates of infant mortality, stillbirths and cancers seen in the children of survivors so low?

According to the ABCC study, death rates from cancers in children of "exposed" and "unexposed" survivors were 20 per cent lower than in people of the same age in the rest of Japan. The researchers' explanation of this is that cancer rates are rarely uniform within a country and it therfore makes no sense to compare results gathered in specific towns and cities with national averages. But cancer epidemiologist Scott Davis and biostatistician Ken Kopecky, who have both worked at RERF, told the court that it was reasonable to presume that the ABCC study had missed some cases of leukaemia, particularly in the early years of follow up when conditions were difficult, and that this may have contributed to the low cancer rate. Schull conceded that just ten misdiagnosed leukaemia cases among children of "exposed" survivors could have obscured a link between the cancers and inherited effects of radiation exposure. One potential source of error highlighted in court was the risk of misdiagnosing leukaemia as respiratory disease: children with leukaemia are 300 times more vulnerable to pneumonia.

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The frequency of stillbirths among atomic bomb survivors was recorded to be six times lower than the number of stillbirths recorded by the Japanese government for the districts of Hiroshima and Nagasaki as a whole, and which included individuals who were too far away from the nuclear explosions to be irradiated. Neel argues that this gap reflects differences in the definitions of stillbirth used by the ABCC and the Japanese government. The government figures are relatively high, he maintains, becuase unlike those from the ABCC they include babies who lived for a few hours and then died — cases which the ABCC counted as infant deaths and some deliberate abortions. The ABCC figures, on the other hand, are relatively low because they exclude miscarriages before the fifth month of pregnancy (the Japapnese government's miscarriage records start from the third month) and stillborn babies with major malformations.

But such differences cannot be the whole story, argue critcs, who raise three problems. First, since the ABCC was counting as "infant deaths" cases which the goverment termed "stillbirths", one might expect the ABCC's infant mortality figures to be higher than those collected by the Japanese goverment for Japan as a whole. In fact, the opposite is true. Secondly, the government stillbirth rates for Hiroshima and Nagasaki were based on medical data for the surrounding rural areas as well as for the cities them selves. (Unlike the ABCC figures, which were largely confined to the cities.) This makes the real gap between the ABCC and government data even greater, for the official stillbirth rate for cities in Japan was almost twice the rate for rural areas, according to 1950 figures.

Finally, even without adjusting for urban-rural differences, it is hard to make the government and ABCC figures tally. Adjusting the ABCC figures so as to include babies stillborn between three and five months gestation and those with major malformations would increase the ABCC figures by about 65 %, while adjusting the government figures so as to exclude deliberate abortions would produce a 10 % reduction in the official stillbirth rate. The government and ABCC figures would still differ by at least a factor of three. Alberman's conclusion about the ABCC stillbirth figures: they fail to include babies that should have been registered but possibly died before registration.

Infant mortality rates for children of "exposed" and "unexposed" survivors were 35% lower than in Japan as a whole. In the 1940s and 1950s most infant deaths in Japan were caused by infectious diseases like T.B., Cholera and Pneumonia, which exacted their biggest toll on poor, badly housed families with little access to health care. Neel told the court that the most likely explanation for the low infant mortality figures was "that living conditions were difficult in Hiroshima and Nagasaki prefectures, but they were more difficult elsewhere." If that is true, than things must have been very bad indeed elsewhere. Neel and Schull agreed in court that there was a shortage of trained medical staff and diagnostic equipment in Hiroshima and Nagasaki in the first few years after the bombs, and in a 1990 paper they state: "It is not unreasonable to assume that the aftermath of the bombing worsened the socio-economic status of many survivors." As late as 1968 the Japanese government felt the need to pass a special kaw "to extend welfare, by providing special allowances, to A-bomb survivars who suffered injuries and even now experience special hardships."

Until the recent High Court case, the unusually low rates of stillbirths, mortality, congenital malformations and cancer reported for the children of atom bomb survivors had barely been debated by scientists. Why? One reason is the authority the ABCC study has'acquired as a yardstick for asessing the risks of direct exposure to radiation on nonreproductive (somatic) cells. Many governments frame their rules on occupational exposure on the basis of the Japanese data. If there is nothing wrong with the data gathered from people who were diirectly exposed, ask most scientists, why should there be anything wrong with the data gathered for survivors' offspring?

But the acceptance of the somatic studies has not been universal. For three decades, Alice Stewart, an epidemiologist from the University of Birmingham, has argued that the data underestimate the risk of cancer developing in children exposed to radiation while still in the womb. Stewart discovered that children who had been exposed to X-rays in the womb were 60 per cent more likely than average to develop cancer. In contrast, the follow-up study of Japanese children who had been exposed to radiation while in the womb found no increased risk. Many scientists belittled Stewart's findings for several years, until other epidemiological studies began to confirm them.

Commenting on the discrepancy between the Japanese studies of womb exposure and data from Western populations, Nick Day, director of the Medical Research Council's Biostatistics Unit, said in court: "Instead of two childhood cancer cases (linked to womb exposure) observed in the survivors, you would expect 11.45. So between 11.45 and 2 there is clearly quite a divergence. The results on womb exposure show most dramatically how the studies on atomic bomb survivors have been allowed to take precedence over other studies that have produced conflicting results. Now that Stewart's results have been confirmed, the RERF researchers are claiming that their study is consistent with hers. Is the same likely to happen with the paper by Gardner? Time will tell.

Sara Downs

Retinoblastoma and Low Level Radiation

Twenty times more common in children whose mothers have lived in Seascale

The village of Seascaie, near the Sellafield nuclear reprocessing plant, is best known in epidemiological circles for its longstanding high incidence of malignant disease in young people, which has recently been confirmed as having persisted during 1984-90. Throughout, the excess has been largely accounted for by leukaemia and non-Hodgkin's lymphoma. No cases of retinoblastoma have been found in Seascaie, but at least five cases have occurred in children whose mothers had lived there at some time during 1950 onwards. The maternal grandfathers of three of these children had worked at Sellafield. Three further cases have occurred among children born in Copeland, the county district that contains both Seascale and Sellafield, but whose mothers had never lived in Seascale; the father of one and the paternal grandfather of another had worked at Sellafield.

Controversy continues over the possible causes of the excess of leukaemia and lymphoma in Seascaie. Gardner and colleagues concluded that the excess was restricted to children of mothers who were resident in Seascale at the time of the birth, but Kinlen has recently shown that a similar excess exists among young people in Seascaie who were born elsewhere. In **their** case-control study of young people in West Cumbria diagnosed during 1950-85 Gardner et al found **that the** excess occurred among children **whose fathers** had been exposed to high levels of radiation before **the** child was conceived and suggested **that some cases may have resulted from paternal germ cell mutation. This does not, however, account for the excess among those born outside Seascale.**

Epidemiological evaluation of the apparent association of retinoblastoma with Seascaie is, if anything, even more difficult. Retinoblastoma occurs in two forms. Hereditary retinoblastoma is nearly always bilateral (both eyes) and occurs in families in which there has been a germ cell mutation. About two thirds of hereditary cases arise from new and one third from old germ cell mutations. Non hereditary retinoblastoma is caused by two mutations to a somatic cell and is invariably unilateral.

One of the cases linked to Seascaie is known to be hereditary. This was in a girl with no family history of retinoblastoma who developed bilateral tumours; she had a partial deletion of chromosome 13, which was not present constitutionally in either parent and thus represents a new germ cell mutation. It seems likely that most of the remaining, unilateral cases are non-hereditary as probably under one in 10 cases of unilateral retinoblastoma is hereditary. At first sight it is puzzling that no case has been diagnosed among children who were themselves resident in Seascaie. although the observed incidence among children of mothers who had previously lived there has been calculated to be about 20 times expected. Even if the risk was indeed 20 times that in the rest of Britain, only one case of retinoblastoma would be expected in Seascale every 40 years

Virtually nothing is known about the causes of non-hereditary retinoblastoma or of mutations leading to the hereditary form. The cumulative incidence for combined hereditary and non-hereditary forms of the condition ranges from 45-60 cases per million among mainly white populations to about 100 per million in Nigeria and

Uganda; the highest recorded rate, though based on only 11 cases, is 153 per million among Navajo of the southwestern United States.

Little international variation exists in rates of bilateral retinoblastoma, with cumulative rates generally of 15 25 cases per million, whereas the incidence of the unilateral, predominantly non hereditary form ranges from 30 40 cases per million in many industrialised nations with temperate climates to about 75 per million in tropical Africa and 125 per million among the Navajo. These data indicate that non hereditary retinoblastoma is more common among populations of low socioeconomic status and in tropical climates.

The only published case-control study of retinoblastoma included 67 sporadic hereditary and 115 non hereditary cases in North America. There was a significantly raised odds ratio for non hereditary tumours among children whose mothers had never attended high school, again pointing towards an association with poor socioeconomic conditions. Seascale, however, has a population of an unusually high socioeconomic status.

Antenatal obstetric irradiation is the only environmental factor certain to cause more that a handful of cases of childhood cancer in Britain By far the largest body of evidence for this is the Oxford survey of childhood cancers, but separate analyses of retinoblastoma in the survey have never been published and, as cases were ascertained from death certificates and survival with retinoblastoma has been very high for at least half a century, it contains very few cases of this tumour. In the American study, for sporadic hereditary cases there was a non-hereditary cases there was a non-signifi-

'cant raised risk with exposure to x-rays during pregnancy. Many Navajo have been engaged in uranium mining, but information on exposure to ionising radiation was apparently not available for the affected Navajo children or their parents. A large study linking the records of the National Registry of Childhood Tumours with those of the National Registry of Radiation Workers is in progress, and this should show whether there is a raised risk of childhood cancer in general, **or** of particular types, in the offspring of radiation workers and, if so, whether the risk is related to the dose of radiation.

The best available method for moving closer to solving this puzzle may be to study DNA from the affected children, as this might distinguish somatic **from germ line mutations. If a mutation could be found in tumour** material this would lead to a search **for** constitutional **mutations in the child** and his **or her parents. If germ line** mutations are found the **type of** mutation might shed light **on** their cause.

C.A Stiller
British Medical Journal: 21.8.1993.

Taking an Industry to Court

The author of this article as well as that of the first article on Sellafield, Sara Downs worked as a researcher for the firm of solicitors for the plaintiffs in the Hope & Reay -Vs-British Nuclear Fuels case. She visited Vedchhi in September and wrote this article. This was before the judgment in the case had been delivered. In India too, we have many cases of personal injury caused to people living in the vicinity of nuclear establishments. This article gives a foretaste of the kinds of problems the victims are likely to encounter in their efforts to obtain justice from the legal system.

This article relates lessons learnt during the preparation of a case recently heard in the British High Court: [Hope & Reay -Vs- British Nuclear Fuels public limited company (BNFL)]. Vivien Hope and Dorothy Reay lived near the Sellafield nuclear reprocessing plant in Cumbria, owned by BNFL. The incidence of leukaemia and non Hodgkin's lymphoma among young people living near the plant between 1950-1991 has been shown to be more than 15 times higher than expected. Vivien had contracted non Hodgkin's lymphoma and Dorothy had contracted leukaemia. Their case was that radioactivity from the Sellafield plant caused or materially contributed to their cancers. Although this was a personal injury claim for damages due to radiation exposure the lessons learnt are relevant to other personal injury claims by members of the public against a large industry in the civil courts.

Considering a Case

One must be convinced that the claimant (the potential Plaintiff) has a **good case. Running this type of cases is expensive and extremely hard work for everyone involved. The industrial company against which the claim is to be made, will undoubtedly have greater resources than those available to the Plaintiff. In general also the scientific community are more likely to be on the side of the industrial company because there are large gaps in our knowledge of the precise effects of industrial pollutants, and scientists are by their nature conservative. Or they may be sympathetic to the Plaintiffs' case but their work might be funded by grants given directly or indirectly by the industrial company to be sued. They will be reluctant to prejudice these.**

A strong case which results in a successful claim may open the door to further claims where the evidence is less compelling. A weak unsuccessful claim is likely to close the door to a later stronger claim even if the evidence is compelling. The Plaintiffs legal costs legal costs may well have be raised through fund raising activities.

If the case is unsuccessful, people will

be reluctant to contribute to further cases.

There is sometimes an argument for delaying a claim until scientific research crucial to the case has **been** completed. In the Sellafield case it would have been risky to have made a claim for damages on the basis of anecdotal evidence that childhood cancers were in excess near the plant. The claim became much stronger once further epidemiological studies of the area had been completed **and** the scientific community accepted that the excess was not a chance phenomenon.

Law

The law and legislation relating to the plant's operation must be thoroughly reviewed.

The plant may have been under the control of more than one company or government body and claims should be made against all of them in the initial writ.; unless **the more recent operators have taken on all liabilities re-**

suiting from the previous operations. In the early stages of the case it may seem clear that only one particular operation or operators are responsible, but one can be certain that one is only aware of a tiny proportion of what will be known by the time the case is heard in court. At that stage it may be apparent that operations by other operators of the plant had their part to play in causing the damages. If their contribution is crucial and they were omitted from the initial writ, the claim will fail.

There may be a number of causes for action and it is essential to be aware of them all so that the one most easy to prove is followed.. In the Sellafield case, conceivably a claim could have been made on the basis of negligence under the common law. However, on reviewing the legislation it became apparent that the Nuclear Installations Act 1971, placed nuclear installations in the UK under a strict liability to compensate for damages. This meant that only causation had to be established by the Plaintiffs and not negligence as well. Negligence is often difficult to prove because it requires showing that the operators reasonably should have been aware of the risks resulting in the damage to the claimant.. In the Sellafield case this could well have doubled the time spent preparing the case and the time spent during the hearing.

The Plaintiffs

From service of the initial writ the Sellafield case has taken four years to prepare and be heard in court. This is short for a case of this complexity and nas only been possible by having the equivalent of two solicitors and one and a half researchers work on the case full-time.. There were also four barristers working intermittently on the case during it's preparation and full-time once the court hearing began.

The Plaintiffs must be made aware of the fact that legal proceedings are lengthy and they themselves must be convinced that the claim is important enough to them to it see through to the end of the court hearing. They must be able to ignore criticism of their action. This may be difficult, particularly where the local community is economically dependent on the continued operation of the plant, as in the case of Sellafield. Avery high proportion of the West Cumbrian population work at the Sellafield plant. 90% of the male population in the village closest to the plant (Seascale) , where Vivien lives with her family, work there. Many local people see the families and lawyers making claims as greedy, publicity seeking and guided Only by self interest. Local press is unsympathetic to their cases. One family has had to face pictures of their daughter who has died of leukaemia in the local paper alongside comments that her case is responsible for the hesitation of the British Government to give the go ahead for the operation of a new reprocessing plant (THORPE) on the site In these circumstances it is invaluable to have a local support /pressure group sympathetic to the fa'milies cases. They can disseminate information to counter the pro nuclear lobby in the area and also help contact oetween families taking similar actions.

Evidence and Experts

The evidence provided to the court will be in the form of testimonies from experts as well as factual evidence from the families and other local people. Proof of causation in the Sellafield cases relied principally on scientific evidence and 90% of the time during the Court hearing was spent listening to examination and cross examination of this evidence. There was evidence from over 20 scientific experts from all over the world and it look over 7 months to hear. Many experts were needed because scientists generally have only a narrow field **of expertise.**

Choice **of** scientific **experts takes** time. Initially **both the** solicitors and researchers working on the case need to become thoroughly versed in the scientific issues under scrutiny. Only then will they be able to make an informed choice of experts. It takes time to find out who are the experts in a particular field. One also must ensure that one's experts are known as impartial. The opposition will investigate each experts' background in detail. Any evidence of bias will be drawn to the courts attention during cross-examination. This is especially important for the Plaintiffs. Judges seem inclined to view scientists working for industry as impartial and those with substantial contacts with pressure groups as potentially biased. In the Sellafield case a large proportion of the Plaintiffs experts came from abroad, not only because they had expertise unavailable in the UK but in some instances because they were not dependent on research grants given by the nuclear industry in the UK.

The other type evidence presented by Plaintiffs is that obtained through "Discovery". In the UK the rules concerning discovery are extremely powerful and the Defendants are under a strict duty to provide all documents in their possession relevant to the case apart from correspondence with their solicitors and those produced as a re suit of the legal proceedings. A common trick of Defendant solicitors is to delay production of discovery documents so that the Plaintiff 's solicitors and experts have as little time as possible to review the documents and ask for further documents. It may be necessary to apply to the court for an Order that the discovery documents are produced within a specific time scale. It is not unknown for the discovery documents most useful to the Plaintiff's case to appear in the last lists produced by the Defendants

Standard of Proof Required for Causation

In UK civil courts the Plaintiff is required to show that "on balance of probabilities" the Defendants activities have caused the damage. In other words, it is at least 51% more likely than not that the Defendants activities are the cause. By comparison scientists demand a higher standard of proof. Most scientific journals will not publish papers showing an association where this is not statistically significant.. Conventionally statistical significance is said to be reached where it is calculated there is a less than 5% likelihood that chance is the explanation for the association..

When to Take Legal Action

Despite the publicity that a legal case can bring to an issue it should not be contemplated unless there is a good chance for success. Firstly because one is raising false hopes in the Plaintiffs, who have already been victims. And secondly because the money that would be spent on legal costs could be more productively spent elsewhere.

Running a case of the complexity of Hope & Reay -Vs- BNFL is expensive. **To have even a chance of winning Plaintiffs must be in a position to have expert evidence of similar quality to that of the Defendants and also the facilities necessary to respond quickly and efficiently as the case proceeds. The total amount spent by the Defendants and the Plaintiffs in the Hope & Reay -Vs- BNFL is estimated to several million pounds sterling. Similar cases are likely to be expensive in whatever country the action is taken.**

Hope and Reay were funded by the Legal Aid Board in the UK. This government body provides financial aid for legal costs to persons on a low income where there is a reasonable chance of their case succeeding. If Vivien and Dorothy win, the Legal Aid Board will recoup it's costs from the Defense. If they loose, the board will have to bear the costs for the Plaintiffs case although neither they or Vivien or Dorothy will have to pay the legal costs of the Defense.

Despite the above, legal proceedings should be considered where is no prospect of the polluter compensating a victim or even making it's activities less harmful. A successful case is very convincing evidence that an industrial plant is causing damage to its local community, and a step towards halting damaging activities. If the claims by Vivien and Dorothy succeed, this will profoundly influence public opinion towards considering the Sellafield plant responsible for the cancer excess in it's vicinity. By contrast it may take years for a definitive statement regarding this effect to emerge from the scientific community. But most importantly a successful claim will enable victims suffering today to gain some compensation for the damage they have suffered and recognition that they have been wronged.

Sara Downs 7 September, 1993

Much A Dooum on the Cooum

The first fortnight of October witnessed hectic activity on the banks of the Cooum in Madras. The notorious stench of the river was forgotten as hundreds of workers were pressed into action building a temporary embankment. 880 trucks were put to use dumping over 16,000 tons of gravel and 10,000 bags of sand. The reason behind all this activity was fear of radioactivity. Some disgruntled employees belonging to an American company, Haliburton Offshore Services Inc., had thrown three radioactive sources into the river. This company was engaged in off-shore oil exploration work and following the incident, the Atomic Energy Regulatory Board (AERB) directed Haliburton to suspend well logging operations in five western region rigs and two southern rigs.

Haliburton is the largest US. company supplying equipment to the oil industry. It is a subsidiary of the McDermott Corporation, whose primary nuclear subsidiary is Babcox & Wilcox, the compan that designed and engineered the il-fated Three Mile Island reactor. In recent years Babcox & Wilcox has specialised in fuel fabrication and reactor engineering for the US. Navy's nuclear submarines.

Newspaper estimates put the cost of building the embankment, which had an internal diameter of five metres, at around Rs 40 lakhs. A giant excavator was pressed into service and a hollow cylinder was lowered into the river

High Explosives Seized at RAPS

Explosive material was siezed by the Rawatbhata police form outside the premises of RAPS 3 & 4. This includes 51 bags each of 2.78 kg of gelatine powder and 46 bundles of fuse wire. A case has been registered under section 5/9 of the Explosives' Act against ShriSafiMohammad and Santosh Kumar, lincensed blasters who had been hired by some of the contractors of RAPS 3 & 4 for unauthorised blasting. The matter is still under investigation by the police at Rawatbhata.

7.2

and water was pumped out. Remote controlled equipment was used to extricated a two and a half inch long capsule containing about 150 gms of caesium-137. This was done on October 17th. A further four days of effort was required to retrieve the two americium-beryllium neutron sources. Divers went diving in the stinking slush of the Cooum and they used the most sensitive equipment—their feet—to locate and retrieve the lost sources. Now there is the question of what to do with the embankment. Some have suggested that a park be built there but any permanent structure at the mouth of the river would interfere with tidal back flows into the river. Of course the cost of dismantling the structure would be at least, another 40 lakhs. (Just for information sake, could a reader from Madras please inform us as to what was finally done?)

While the dedication and the effort displayed by Dr Gopalakrishnan (Chairman, AERB) and other members of his team in trying to recover the lost sources is worthy of commendation, the same cannot be said regarding their efforts to inform the public. Here the age old mindset of "allaying public fears" by hook or by crook held sway. Dr R Chidambaram, the head of the Atomic Energy Commission went so far as to claim that "No harm will be done even if the sources remain in water and slush for a thousand years." Dr Gopalakrishnan was a bit more circumspect claiming that "it was unlikely that any leakage of radioactivity can take place from these sources as the radioactive material in them is in a physical and chemical form where its teachability in water is extremely low." He also observed that "Cooum water is not potable and it is not used for industrial purposes either."

After the recovery of the caesium source Dr Gopalakrishnan made a more relevant pronouncement. He said, The gamma source (caesium) which we have taken out will emit 5,000 rem per hour on contact and the high dose of radiation will cause severe burns if the capsule was held by hand directly. But once it was put inside the container with lead shield, the radiation outside the container is only 10 millirem per hour, which is acceptable."

While information regarding the activity of the two americium-beryllium sources was published in the newspapers (18.5 and 0.5 curies respectively) no information was forthcoming regarding the activity of the more pene trating caesium source. However, from the fact that it was emitting 5,000 rem at contact one can estimate that the capsule contained about 150 gms of caesium with an activity of 15,000 curies. This represents an enormous amount. For comparison one can only mention that the entire amount of caesium that was deposited on the whole of West Germany following the Chernobyl accident was estimated to be just 100 gms. This amount was sufficient to cause a measurable increase in neonatal mortality and in the number of birth defects in children con ceived during the period. The same amount of caesium was responsible for the horrible accident involving a similar radioactive source at Goima in Brazil in 1987, in which four people died of acute radiation sickness and more than 240 were contaminated and which resulted in social ostracism of residents of the whole city of over 1 million people.

The statements by nucleocrats instead of allaying fears are more likely to add to public anxiety because they do not gel with their own hectic activity If the material was so harmless then why expend this huge effort and money to retrieve the sources? Obviously, nucleocrats did not consider (and very rightly so) the sources to be incapable of causing grievous harm. Although the source might have been in a chemical form which was insoluble in water, at the time they were thrown in the river, there is no guarantee that the material would not react with salt water and produce chlorides of cae sium which are certainly teachable.

After the sources were recovered, they were handed over to the police for getting the clearance of the court and for restoring to safe custody' of Haliburton Inc. Although the caesium source by then was securely placed within its lead shielded casing and emitting 'only' 10 millirem per hour, still these 10 millirems are likely to add up to something well over a few hundred millirem for the poor policemen whose duty it would be to keep a watch over the room where the sources were kept. Were these people informed of the risks they were running guarding the property of Haliburton Incorporated? The acceptable' (according to nucleocrats themselves) limit for ra diation dose for the general public (ineluding members of the police) is |ust 100 millirem per year

The incident on the Cooum brings into focus some points regarding the use of nuclear energy. One of the slogans used by antinukes in Europe after the Chernobyl accident was "Chernobyl is everywhere." This incident illustrates the truth behind this expression. Nuclear poisons can cause devastation and these poisons are not confined to nuclear reactor sites. They are in use in hospitals, industrial units, universities and laboratories and oven in the field offices of multinational cor poration like Haliburton Inc.. where their disgruntled employees can easily lay their hands on them Thousands of people have access to them. To expect that all these people would behave in an exemplary and responsible manner while dealing with these dangerous materials, is to expect too much. This makes the nuclear issue a matter of concern not only for those unfortunate enough to have a nuclear establishment in their vicinity, but for everyone. There is a lesson for nucleocrats. as well. Their knee-jerk "allaying of public fears have made even their well meaning words and actions suspect in the eyes of the public What they needed to do in this case was to take the opportunity to educate the public. Given out all the technical information so that other independent 'experts' could have formed their own conclusions and quantified the risk as precisely as possible so that the public would understand what was involved and what measures to take. The other lesson concerns us as a nation in this era of globalisation. Multinational overseas adventurers like Haliburton would become more and more involved in the 'discovery' of India. Unless they are severely and strictly regulated such incidents involving dangerous and toxic poisons will become more and more common in the days to come.

Sanghamitra

Are Multinationals Above The Law?

The Rules

If a radiation source is proposed to be handled in an open field, prior approval of the location where the source is proposed to be handled should be obtained by the user. Such open field application could be undertaken **only** when a) it poses no radiation hazard to those present around the proposed location of use and b) adequate space is available, to cordon off suitable area in order to ensure that no worker or member of the public would receive amounts of radiation dose in excess of specified limits.

The source of radiation should be safely stored in a location which is **duly** approved. The storage should be chosen that it would be free from potential fire-hazard, flooding, water-logging, etc. Further, to avoid loss by pilferage or otherwise, adequate security should be provided for the source of radiation.

Personnel who would be actually working with the source of radiation should be regularly monitored for the amount of radiation dose received by them in the course of their work.

Depending upon the type of use and the nature and amount of radiation sources handled, the applicant should be equipped with safe handling accessories as specified.

Has The AERB Taken Any Action?

It is obvious from the above that the dumping of radioactive sources in the Cooum River is a gross violation of the rulesl regulating the use of these sources. The responsibility lies not\ only with the disgruntled employees but also with Haliburtonl which failed to provide "adequate" security? Now that negligence on part of this multinational has been prima facie established, will the AERB take legal action against the company for endangering public health and safety. Or is the Atomic Energy Act only meant for desi activists ?

Rally at Rawatbhata

are than 500 people from Rawatbhata township and **surrounding** villages took out a rally on 26th of OctoDerJ993, to protest against the harmful effects of radioactive emissions from the nuclear power plant and against the dishonesty of the plant authorities.The rally gave a memorandum to the local assistant collector. The memorandum listed many demands which included demand for the construction of a referral hospital at Rawatbhata especially in the context of the increased morbidity due to nuclear pollution; facilities for treatment at the plant hospital in Rawatbhata in the mean-time; the closing down of the damaged unit-1 which has cracks in the end-shield; training for facing of emergency situations; construction of side roads and the establishment of a college and a technical school at Rawatbhata. The Assistant Collector promised to connect the nearby villages with the Rawatbhata grid by November 2nd, 1993.

After the rally, there was a public meeting at the market square of Rawatbhata, where villagers spoke of their difficulties. One of the major concerns expressed by a number of villagers was the absence of reliable electric supply. They said that the one 'benefit' for which they had paid an enormous price, was being denied to them! They had not only faced eviction from their ancestral lands when the dams were constructed but were now undergoing severe hardships due to diseases caused by radiation pollution. Shn Mangilal Gujjar of Loharia village said that he had within the last two years taken 128 patients from his and surrounding villages to Udaipur for treatment of T.B. The sarpanch of Eklingpura described how because of absence of roads, severely ill patients had to be carried on a cot. He said that we provide thembasic necessities like milk, vegetables and cereals, why can't some of the budget be spent on our wellbeing? Dr Rampratap Gupta, said that despite the billions spent on the construction of two hydroelectric dams and two units of the nuclear power plant and heavy water plant, there is growing poverty and unemployment in the region, and a great paucity of educational and health services. This was proof that our planning process was defective and had not contributed towards the benefit of the majority of our population and we needed to rethink our developmental policies. Surendra and Sanghamitra Gadekar of Anumukti also spoke at the meeting. They talked about the implications of the results of the survey on the health of the people living in the vicinity of the plant and also about the need for continuous monitoring.

The chairman of the Parmanu Pradushan Sangharsh Samiti, Shri Ratan Lal Gupta said that various small accidents that had taken place in both the nuclear power plant and in the heavy water plant were just warnings that Rawatbhata was sitting on a time-bomb. He warned the authorities that if the demands of the local population were not granted then the public would be forced to take recourse to agitation and legal redress. The meeting ended with a firm resolve to continue the struggle.

Physicians call for a boycott Siemens

The International Physicians for the Prevention of Nuclear War (IPPNW) is calling for a worldwide boycott of medical instruments supplied by the Gernan company Siemens. IPPNW, a federation of national physicians' groups in 80 countries is demanding that Siemens leave the nuclear business. The announcement came at a press conference in Munich on 9th of August when Michael Roelen, Secretary of the German section of the organisation, said that begining from September 1993, physicians belonging to the organisation including the 10,000 members of the German section, are being urged not to buy Siemens' products any more.

A spokesperson for Siemens AG. Norbert Bocker, has said he wanted to begin a dialogue with the IIPPNW. but the call to boycott might not be favourable for such a dialogue. He said that it is still too early to take legal steps, implying that the company might take the physicians' organisation to court over the boycott.

The boycott is part of an international campaign by the IPPNW which aims to ban plutonium production by the year 2000. From what Till Bastian, former secretary of IPPNW said, the action should be seen as "an 'ncentive" to the company to get out of the nuclear business. Its share of the nuclear-related work has already fallen from 20 percent to two percent, according to IPPNW estimates The or ganisation also wants an end to the production of MOX fuel rods in Siemens' Hanau plant.

An IPPNW study Plutonium: *Deadly Gold of the Nuclear Age* published last year warned of the dangers of approximately 520 tonnes of plutonium currently existing world-wide. Plutonium should no longer be treated as a 'raw material' but as what it really is a deadly poison.

WISE News Commurvque:397 3.9. '93,

Australian Environmentalists Block a New Reactor

Like India, Australia has a nuclear establishment—sort of. It does not have the kind of facilities that BARC has—indeed it hasn't got BARC's bite—but there is a nuclear research establishment, conveniently situated between a national park, a vast rubbish dump and the fastest growing suburban area in all Sydney. A perfect site for a reactor.

The reactor concerned isn't much to write home about either. In 1954 British announced they would give one in exchange for the privilage of using the Australian desert to test nuclear weapons. The reactor was completed in 1958 and entered full-power operation in 1959.

The reactor is known as HIFAR' (High Flow Australian Reactor). It belongs to a small group of similar reac tors whose design dates from 1954, when it was 'the state of the art' for research reactors. Two similar reactors. DIDO' and PLUTO' were built in England at the Harwell research establishment, and have now been in shutdown after doubts were raised about their safety by a senior Harwell engineer. Another similar reactor is operating in Denmark, but with advanced equipment that HIFAR hasn't got. Another in Germany has been rebuilt at vast expense, as has one in Japan.

In the early stages of HIFAR's operation, research was done in areas of material testing, (for power reactors) and neutron scattering. A lot of money was wasted in trying to design and test materials for a beryllium moderated reactor for use in desert areas a project which, when it was abandoned, left behind lots of waste that is still lying around. Weapons-related research was also carried out, and an Australian nuclear weapons lobby emerged.

By the 90s it was clear that Australia wasn't going to have either nuclear weapons or nuclear power, and HIFAR was left without a role. At the same time, major problems were starting to emerge with HIFAR safety: The cooling system in the reactor's thermal shielding had cracked and thousands of gallons of water were leaking into the room below where pumps for the

heavy water were situated. Problems had also emerged in the heavy-water heat exchange system.

'ANSTO'—Australian Nuclear Science and Technology Organisation (the successor body to Australian Atomic Energy Commission),, has a problem in justifying its existence, and the large amounts of taxpayer dollars needed to keep it afloat and to keep the now well and truly aging HIFAR operating.

ANSTO saw salvation for HIFAR and itself in two areas: neutron scattering research and radioisotope production.

Neutron scattering, according to ANSTO, is one of those wonderful 'cutting edge' technologies that will lift Australia from its antipodean slumber and propel it into the 21st or 22nd century, while radioisotopes production will save the lives of all those whose trip into the 22nd century has been too much for them, and who have developed cancers or heart conditions.

So, what is 'neutron scattering'? Neutron scattering involves the penetration of matter—bits of plastic, metal or pharmaceuticals or whatever—by beams of 'cold', 'hot' or 'theremal' neutrons to examine its structure. Neutron scattering has been done at HIFAR for many years but it has singularly failed to galvanise the Australian R&D scene. A few dozen researchers perform esoteric experiments on 'Kondo' systems, spin glasses and supermagnets. They are mostly costly experiments. The queue of eager corporations waiting to do market driven R&D on HIFAR just hasn't materialised. It is the same situation all over the world.

ANSTO rather believes that HIFAR is out of date and needs upgrading. They now want a new reactor with three times the flux, one and a half times the power and the latest in equipment. A careful look at ANSTO's own figures however, showed that even a new state of the art reactor, —a mere snap of course at $200—400 million, will in fact put Australia about 12th or 13th in the world neutron scattering stakes. Hardly an impressive achievement! This reactor would be the single most costly item in Australia's R&D budget for many years. Meanwhile, programmes like solar energy, in which Australia at one time used to lead the world, have long since migrated to California and Japan where there is much less sun. Is this really the sort of priority Australia needs to propel it into the next millenium's technological wonderland.

Friends of the Earth, Sutherlandshire Council and Greenpeace have all spent the last six months arguing before a commission of enquiry that this is not an appropriate way of spending taxpayers' money and arranging among other things, for the commissioners to talk to that Harwell engineer who voiced doubts regarding the safety of HIFAR's brethren, DIDO and PLUTO. We have burned the midnight oil going through ANSTO's own figures with a fine toothcomb (well, actually a pocket calculator) and spent hours on the computer, the fax machine and the phone. We told the commission that a new reactor was a waste of money and HIFAR itself is an accident waiting to happen and should be decommissioned immediately. We pointed out the potential problems with HIFAR's emergency shutdown system, its lack of a backup shutdown system, and problems with the the uninterupptible power supply which in their own words, "has never operated satisfactorily."

In addition, we pointed out that most of the research that goes on at ANSTO's Lucas Heights site is in fact not reactor dependent at all, and neutron scattering is, in fact, the second smallest programme at the site, with far more effort going into other fields of research. If HIFAR were to disappear tommorow, most of these programmes would be largely unaffected. The only research programme that would actually disappear would be the neutron scattering programme itself.

ANSTO, as well as arguing the merits of neutron scattering as an entree to the next millenium, argued.that HIFAR was needed to produce medical isotopes. It turns out that the 'cutting edge' of medical radioisotope technology are accelerators. Many of the isotopes that, according to ANSTO, could only be produced in a reactor, turned out to have active accelerator production programmes elsewhere.

The inquiry's most important conclusion was that ANSTO had failed to make a case for a new research reactor, and therefore, the commission "could not recommend its construction". The commission however, went on to suggest that HIFAR be refurbished—something ANSTO had said "wasn't practicle". It failed to acknowledge the safety problems at HIFAR. Thus the challenge to convince the people and the government that HIFAR should be shut down and Australia should withdraw from its ill-considered involvement in the nuclear fuel cycle, remains.

John R Hallam
6.10.1993

Evolution of an Activist

How I was awakened to the reality of nuclear affairs? In 19851 had a chance to visit BARC in connection with some heating device they wanted. I had known by then that nuclear plants meant many fishy things but had not reached a decision that I would have nothing to do with it. Once inside the BARC, I found it very impressive, almost like a place from a science fiction story. At the nuclear fuel complex, I met a 'scientist named Mr Khurana.

Clad in orange with a picture of Rajaneesh on his chest, he seemed quite at ease in the middle of many strange activities. These are some fuel rods for machining—weH, they have extremely low levels of radioactivity. It cannot penetrate even the skin." I was a little uneasy but walked on bravely with him till we came to a big iron gate because here even the scientist said that the radioactivity could be higher. On his pushing a button, the gate opened sideways and we saw in front a crucible containing uranium oxide for which an ignition device was required and which could be operated without going any closer. I asked what could be the radiation level where we were standing and the answer was that the man who monitored it was on leave.

A few months later we had Chernobyl. That same year it was my previlage to experience the awesome beauty of the Periyar lake in Kerala and later on learn about the poisoning of the Periyar river by the Indian Rare Earths Ltd. (IRE) plant at Alwaye. I could not sleep well because I had done business with IRE...

. ..While going through the account of your cycle yatra I had a strange feeling which I would call healthy jealousy. Every day there are several reminders of the prison that I have created around myself but the cycle yatra also reminded me of the possibilities of fulfilling childhood dreams of adventure with a much greater meaning! I don't know exactly when, but some day I am bound to join you people in your yatra...

I have been trying to gather more information on the Narmada project. It is very distressing to realise that the Gujarati press refuses to see the problem of rehabilitation as it reality is. Even if we accept that the 19 villages of Gujarat can be rehabilitated, it is no more than a small fraction of the task. One hopes that as time passes the real nature of the project will become clearer to those who believe it is inevi table and that there will be a united front of all activists who will support the villagers who will be refusing to move.

Kersi Sabavala

read the news of Kersi Sabavala's untimely death in the newspaper. There it was in black and white Kersi Sabavala is dead. He died suddenly following an attack of malaria just after returning from a business trip to Bombay He was just forty. Even though now more than two months have passed, it is still difficult to adjust to the fact. Wasn't It only yesterday that Kersi had come for the first and alas only time to Vedchhi and we had spent half the night talking? He had said that he would visit again soon and stay at some length and enjoy the peace and maybe write something for *Anumukti.*

I first met Kersi four years ago at a meeting of the Narmada support group in Ahemedabad. After that we met somewhat infrequently at different places usually at some protest action or meeting connected with the Narmada agitation. Superficially, I knew him very little, but deep down I felt we were kins.

Kersi's support to Anumukti during the last four years was extensive and steadfast. From collecting money to putting an advertisement for Anumukti in various 'mainstream' fora, Kersi did it all. Anumukti deeply regrests his death. Below we republish excerpts from some of his letters to Anumukti as a mark of respect.

Blacklisting Nuclear Power

The following is the full text of the letter Kersi wrote to Nuclear Power Corporation on 11th of April, 1990.

We have received your tender enquiry (No:CMM/KAPP/4920). We manufacture a wide range of ovens and furnaces. But as a matter of principle we do not deal with organisations concerned with atomic energy generation. Our stand is based on the following facts:

- Nuclear energy is the source of one of the most dangerous kinds of pollution. Radiation at any level is harmful to life and environment.
- As radiation cannot be measured by ordinary means nor can be sensed by the people, atomic enery experts have succeeded in keeping the population in the dark.
- The harm that the radiation can cause may not be felt in the near future but can be passed on to the coming generations in the form of damaged genes.
- This subtle violence against life and nature is irreversible.
- There is no method yet devised to dafely decommission a ractor after ist short life of 25 years or so is

over. This is a totality unjustifiable liability we thrust upon generations to come.

For perpetuation of the evil of nuclear energy its various agencies are controlled by the power of the state. In countries where people have a say, the dream of nuclear energy has evaporated.

There is always the possibility of a major accident like that of Chernobyl as even for the most perfect machinary the human factor cannot be wholly eliminated.

Nuclear power generation is a big drag on the progress of a poor country like India. With the same amount as sunk in this large scale ego trip, a lot more power can be generated in a decentralised and safer way.

The cover-up provided by the government to nuclear energy establishment in the form of the Atomic Energy Act is contrary to the spirit of democracy.

- The nuclear establishment has kept alive the option of a nuclear bomb which is madness of the highest level.

In view of the above considerations we have no option but to blacklist your organisation.

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Big Dams Spawn Nuclear Power Plants

During a cycle yatra through Narraada valley in 1990, we were often confronted with the question, Are not nuclear power plants the alternative to big dams? We oppose big dams because they cause submergence and destruction. So, how can we oppose nuclear power plants as well? We do need electricity for progress!

The fallacy of regarding nuclear power plants as alternatives to big dams or coal powered plants is a common mistake and occurs because of the perfectly reasonable assumption that since both generate electricity, one can substitute for the other. The truth, is however, very different. Big dams are the mother of nuclear power plants.

A look at the map can clarify the confusion. Rawatbhata Atomic Power plant was built on the banks of the Rana Pratap Sagar reservoir. There were three other dams built on the Chambal within just fifty kilometres. All with electricity generation as a prime objective and yet not only RAPS-1 and RAPS-2 wore built, they now want to build another six reactors at the same site. Similar in the case of Kakrapar Atomic Power Station. The Kakrapar and Ukai dams were built as a multipurpose hydel scheme on the Tapti in the 1960s. The hydro power generation has been far less than what had been expected earlier. The dams were followed by the Ukai thermal power station and now by Kakrapar Atomic Power Station. Here too, although only one reactor is presently operating and another under construction, the site selection has been done with a provision for four reactors. If the neighbouring population were ever to resign itself to nuclear power, and if the Nuclear Power Corporation were ever to get some extra cash, Kakrapar too would soon sprout two mora reactors.

But nothing illustrates the 'family' relationship of nuclear power plants and big dams better than the case of Kaiga. (See "Kaiga left high and dry" in this issue.) Here the construction of two reactors has been going on at full speed with the consequent destruction of the little bit of tropical rain forest still extant in the Western Ghats but the dam which was to provide the water for cooling the plant has got delayed since the World Bank has withdrawn funding and there is some dispute between the contractor and the Karnataka Power Corporation. (1 never thought that a day would come when I would feel thankful towards the World Bank and dam building contractors, but one lives and learns.)

The fact in that nuclear power plants are thirsty beasts. Huge amounts of water are needed to take away the enormous heat generated within their bowels. A 1,000 MW reactor requires about 50 cubic metres of How per second. This is nearly the flow of a good sized river or a large canal, To reduce the requirement of water, new plants have gone over to the 'closed circuit', where the cooling water is recirculated after cooling in cooling towers. For those systems although the amount of water required becomes much lean (around 3 cubic metres for a 1,000 MW plant) it is still substantial. In times of severe drought, when electricity would be most needed because of the shortfall in hydro generation and the greater need for irrigation, nuclear power plants may become inoperational because of lack of cooling water. This has happened in Prance. Nuclear power plants can thus only be built in the vicinity of large bodies of water and these large water bodies are most easily created by damming rivers.

At the time when dams are planned, nobody, not even the nuclear lobby thinks the imminent appearance of a nuclear power plant in the intermediate future as a 'benefit'. Amongst all the claimed benefits of a dam, power, irrigation, flood control, fisheries, compensatory afforestation, bringing tribals and other displaced beings into the 'mainstream', etc. there is never even a mention that soon the place will become a site for a lovely 'clean', safe and too cheap to meter nuclear power plant. Yet, as we see in all the cases mentioned above, these calculations are made by the policy makers sometimes many years in advance. Kaiga is illustrative, only because perhaps these calculations had not been made and Kaiga was chosen as a site in something of an unusual hurry and thus we have the beautiful prospect of the Nuclear Power Corporation losing Rs 1 crore every day in interest charges while the Karnataka Power Corporation and its contractors haggle over prices.

There is a lesson in all this for antinuclear activists. The proper time to oppose nuclear power plants is before the dam has been constructed. If they can prevent the dam from being built in the first place, nuclear power plants and the almost equally obnoxious coal burning power plants are unlikely to pollute the vicinity. Often small landholding farmers support dams in the hope of irrigation, but if they were to know that irrigation is only a bait while the radiation hook is being readied, they would perhaps be more circumspect in their support for sundry dams of dubious value. Peringome in Kerala is en example of the way governments operate. When they found the opposition to the atomic power plant too hot to handle, talk of the plant was quietly shelved but work has started on the Kakkadavu dam. Once the dam is made, the sword of Democlese would continue to hang over the people of Peringome and Opposing the momentum for the power plant would become much harder.

Surendra Gadekar

Froth the

hat are the alternatives? is a question often thrown at activists opposing any mega project. The question is posed in an unfair manner. The activist is supposed to come with a detailed blueprint with costing and time frames snowing how the 'alternatives' would replace whatever 'benefit' the megaproject was supposed to confer. In the case of power projects, this means accounting for each and every kilowatt with costs worked out to the last paise. It does not help to point out that the lobbies behind the megaproject are paid huge sums of money from the public exchequer to do 'feasibility'studies and impact assessments while the activists have to pay their own passage. It also does not help to point out that the 'experta'advocating the project have invariably been wrong in their cost and benefit calculations in the past. The figures they pop up with so much authority have no relation to reality. The public feels that the activists do not have the proper grasp of the issue which the 'experts'have. Crying about the unfairness of it all, is all that activists most often do.

India is the land of voluntary efforts and one comes across people (even experts) who are willing to give their time and expertise to do these detailed cost calculations with no thought of monetary recompense. Dr. Amulya Reddy and Mr. Girish Sant have done such an analysis with regard to the power generation from the Sardar Sarovar Project. They presented their analysis (with all its gory details and annexures) to the Sardar Sarovar review board. They show that not only are the alternatives environmentally far less damaging and less destructive of people and cultures, they are also much cheaper. Instead of adopting these simple and steps which would reduce demand and help progress towards a more just and equitable society, Mr. Praful Bidwai's article shows what our government is in the process of actually doing—selling the country to foreigners and locking us into extremely expensive power supply.

There is no reason at all why we should not adopt the sensible solutions outlined by Dr. Reddy and Shri Sant to our electricity problems except that they require mobilisation of effort on part of a large number of people and our government is too laiy and corrupt to act, and we are too laiy to force it to act.

Does Sardar Sarovar Make Sense as an Electricity Generation Project?

Amulya Roddy and Girish Sant

The Sardar Sarovar Project (SSP) has both an irrigation and electricity generation component, but this presentation will restrict itself to the electrical part of the project which accounts for 56.1% of the costs and involves a 455 ft embankment that would create a reservoir and lead to the submergence of 240 villages, 40,000 families, 39,000 hectares of land (of which 13,744 hectares is prime forests).

This electrical part of the SSP may be considered to consist of three components:

* Conventional generation from a 436 ft embankment reservoir

* Pumped storage generation from the same 436 ft reservoir

* Generation from an 19 ft increment in height to the 436 ft

Conventional feneration

If one thinks of a hydroelectric project as being based on a waterfall with a high head, then it is important to note that the SSP is not such a project—it is, in fact, a mega-tank where the head is created by the wall or embankment of the tank.

Further, if the downstream canal system is built and in place when the dam is built, than the water can be evacuated from the reservoir as and when required for irrigation and other end-uses of water—and there would be little water available for electricity generation. However, it is envisaged that the canal system cannot be completed before 16 years. *The* situation is quite analogous to many electrical projects where the transmission and distribution are not erected in time to evacuate the electricity that is generated.

This mis-match between the gestation periods of the dam and the canal system has led to the idea of generating electricity from the un-evacuated water. The SSP has two different power stations-a large River Bed Power House (RBPH) of 1200 MW capacity with reversible turbines that can be operated either as pumps or as generators, and 250 MW of conventional generation capacity at the Canal Head Power House (CHPH).

River Bed Power House

The River-Bed Power House is planned to generate electricity in two distinct modes:

* Conventional (or seasonal) generation from the excess water released through the RBPH into the river below the dam after providing for irrigation needs. A large share of generation at SSP would be provided through this mode of operation. As the canal system is built up and is able to withdraw the water, the capacity for conventional generation goes down—and after 15 years, it will go down to 0 MW in the RBPH and 50 MW in the CHPH making a total of 60MW Thus, conventional generation will decline from a firm initial 439 MW to 50 MW after 16 years. So, in costing the conventional generation component of SSP, it has to be treated as a hydroelectric project with a lifetime of 15 years and a declining capacity during that lifetime.

- Pump- back (reversiblo) generation. When excess water is not available for power generation, water stored in a small dam at Qarudeshwar weir is pumped up (by reversible turbines drawing power from the grid) to the SSP dam reservoir at certain times and is allowed to fall back through the RBPH and generate power at other times. This mode is designed to satisfying peak demand for electricity at certain hours of the day, for instance, during the evenings. (About 30% of the original energy drawn from the base-load plants is lost because reversible generator/pumps are not capable of converting the energy with 100 percent efficiency.) In effect, the SSP acta as a "hydel battery" that is charged at night using power from the thermal plants and is discharged to provide power during peak demand.

Canal Head Power House

The CHPH, with conventional (non-reversible) turbines generates power using water flowing in the canals and excess water during monsoons.

The water required for irrigation paseee through the CHPH and is then stored at the canal head regulating ponds. This stored water can be discharged into the canal depending upon demand. These canal-head regulating ponds spread over 773 hectares facilitate CHPH operation in the peaking mode.

During the monsoons, the water is diverted to the RBPH on a priority basis. The remaining excess water is passed through the CHPH

and then released into the river. This seasonal generation will decline as the irrigation network grows.

Overtly Optimistic Estimate

Both World Bank and Central Electricity Authority have made studies of the electricity generation from SSP. However, both these studies over-estimate the peaking conventional generation on two accounts:

- **1. They assume larger regulated water releases from Narmada Sagar project than is likely to be the case. With the delay in the construction of Narmada Sagar Project, the conventional generation is expected to fall by 25% to 28%. The decline in firm generation is likely to be much more. As a consequence, the pump-back mode of operation will dominate more over conventional peak generation than anticipated.**
- **2. Narmada's water flow has subsequently been estimated to be 17.1% less than the flow assumption adopted at the planning stage. This too will decrease conventional power generation, making increased pump-storage operation necessary.**

The decreased magnitudes undermine SSP's usefulness, to a substantial extent as they would essentially convert SSP into a pumped-etorage plant. For pumped-etorage plants, many other better sites are available with substantially lesser submergence. The 1, 450 MW Pimpalgaon Joge Scheme requires less than 0.5% of the submergence of the SSP and costs about 25% less than SSP.

Sardar Sarovar Pumped Storage scheme has not been compared with other alternative supply schemes such as gas turbines and cogeneration from sugar factories. Demand-side management alternatives have also not been compared- This omission is particularly serious because the evening peak in Indian electricity systems is largely due to lighting, and drastic reductions in peak demand can be achieved by adopting efficient lighting devices.,(See the next article on Alternatives.)

Minimal Benefit From Monsoon Base load Powor

A sharp dip in energy demand describes the monsoon period (from the electricity board perspective). During this time, irrigation pumpsets which account for approximately 22% of average grid load, are virtually unused. Historically; the monsoon season is utilised to take coal based power plants sequentially off-line for maintenance. The drop in demand and the already low plant load factor in the Western grid, offer ample lee-way for removing these plants from service. Thus, peak-demand is the factor limiting the number of plants to be taken off-line simultaneously, not the base demand (which is relatively low).

SSP will produce the greatest portion of its energy during the monsoons. After 15th year of operation virtually all of the conventional generation from SSP will be at monsoon time. Existing base-generation is large compared to base demand, particularly during that period. This fact is evidenced by the unusually high grid frequencies during the off-peak hours of the monsoon (high frequency indicates excess generation). Only a small portion of SSP conventional electrcity generation which coincides with the peak demand will be of any real use. Rupees per kilowatt hour is hence a meaningless value for assessing SSP, since much of the electricity will be produced at times when there is little demand for it.

Submorgoneo Duo to tho Powor Component of SSP.

Though the SSP is a multi-purpose dam project, but at least a part of the submergence can be directly associated to the power component.

The Narmada Water Dispute Tribunal (NWDT) increased the Full Reservoir Level of SSP from 436 feet to 455 feet to capture additional generation of 250 to 350 million units per year. Since the height of 436 feet is sufficient to meet all irrigation needs, the increase in height entails an additional submergence of nearly 10.000 ha which is roughly 27% of the total submergence. The extra energy this additional height will yield (230-350 million units) is less than 10% of the total energy. For this trivial benefit, a tremendous price has to be paid—5 villages and an additional 9,500 hectares will be submerged, mostly in Maharashtra.

For operating CHPH (of 250 MW) as a peaking station, a temporary storage is to be created — the canal head regulating ponds or rock filled dykes. These ponds have water storing capacity of 24.25 MCM (million cubic meters). The area submerged by these ponds will be 773 hectares comprising of 5 villages. The pump-back generation at RBPH is made possible by a similar storage created by Garudeshwar Weir. This weir will submerge land on the banks of the river but no estimate of this submergence is available. Hence, a submergence of at least 10,800 hectares can be directly associated to the power component of SSP. This comes to 7.45 hectares per MW of installed capacity

SSP IN PERSPECTIVE

The SSP power plant, with an installed capacity of 1,450 MW, would account for only 5% to 69b of **the** total capacity planned for **the Western** Zone, by year 1997. Capacity **addi-**

tion planning is based on demand forecast studies. Some of the assumption© involved in studies of demand forecasts are erroneous. The latest demand forecast done by Central Electricity Authority (CEA) is the 14th Electric Power Survey carried out in year 1990. This survey assumes peaking availability—(at the bus-bar) of 59.5% for the Western Region by year 1994-95, An availability of 60.36% was already achieved in year 91-92. Further, the survey does not take into account other factors that improve peak availability, such *as* higher availability of new generating plants being added and continued efforts for renovation and modernisation.

Conclusions

There is no justification whatsoever for the negligible generation from the 19 ft; increment in the dam height

Conventional generation declines rapidly to a trivial capacity

The SSP Pumped Storage scheme — to compensate for the weaknesses of the conventional generation — is so intrinsically inappropriate and expensive compared to other options that it is like "throwing good money after bad".

A K.N. Reddy & Girish Sant

The Alternatives

Demand Side Management
A Way Out Of The Present. Mess

The fundamental purpose of the power sector is to satisfy demand for the benefits of electricity such as lighting, cooling$_f$ etc. Traditionally demand has been met by adding generation capacity The possibility of reducing electricity demand through energy efficiency while providing the same level of benefit has been largely ignored. Throughout the world it is now recognised that Demand Side Management (DSM) or efficiency improvement offers a significant and economical method for demand reduction, in effect diminishing the need for new installed capacity. In fact, saving 1 kWh is equivalent to generating more than 1 **kWh** because **the** saving is at the consumer end separated from the generation end by T & D lines with **their associated T & D losses.**

Iarge Savings from Energy Efficiency

Efficiency improvements can play a major and cost-eflective role in demand mitigation. For example, US. electricity demand was anticipated to follow GNP growth according to J 1973 utility forecasts. In fact, even though electricity service expanded because consumers bought additional appliances, etc., electricity use actually decreased and in 1986, the actual consumption was 50% less (1,160 billion kWh less) than. the projections. It has been estimated that the United states currently saves $169 billion per year as a result of end-use efficiency advancements which began in the mid-**708.** As technology evolves, the opportunities for energy savings Continually expand In 1991 US and Canandian utilities alone invested over Rs. 6,000 crores ($2 Billion) on DSM programs, a growing trend.

Opportunist to Surpass the Wort: The Urgency of Imptemtiitatkm

In the matter of efficiency improvements, India has a comparative advantage over Japan, that US, and Europe. In most Western countries, the cheapest efficiency measures have already been adopted during the last fifteen years as a result of which the efficiency of powre utilisation is relatively high. However, many of these very low-coat efficiency improvements have not yet been captured in India which can therefore enjoy much greater incremental energy savings per rupee spent on conservation measure.

In addition, the highly industrialised countries are hampered by comparatively long lead times in implementing energy efficiency improvements because they still have a largo stock of the less efficient infrastructure and equipment from the past. In contrast, in India, industries are being newly established or expanding, many consumers are purchasing their first appliances, etc, Hence, there is considerable scope for efficiency measures **and** an urgency to adopt them as soon as possible, before a wasteful infrastructure becomes established and inefficient equipment is installed. The savings benefits of efficient infrastructure and equipment **propagate** *over* time as do the losses from inefficient versions. Thus, as the nation's infrastructure is being estab-

Option	Life Cycle Cost Rs/kW	First Cost Rs/kW	Electricity Cost Rs/kWh
Compact Fluorescent Lights	13,852	7,611	0.57
Irrigation Pumpset Rectification	21,827	13,941	0.33
Pumped Storage Schemes	27,860	14,530	1.29
Gas Turbines	30,391	8,660	1.18
Cogeneration in Sugar Factories	35,252	28,380	0.69
Combined Cycle Gas Turbines	35,555	17,507	1.39
Efficiencient Refrigerators	36,094	33,954	0.39
Sardar Sarovar completed on time	37,807	30,301	0.96
SSP with a two year delay	45,746	36,665	1.16
Coa	61,808	31,269	1.29

Life Cycle and First Costs of Various Electricity Options

lished and equipment is being installed, there are unique opportunities to surpass western efficiency levels with relatively little financial outlay.

Costs of Various Options

Least Cost planning is fundamental to achieving the maximum benefit from limited resources. Presently, the Western Region is faced with serious, power shortages although the base-load capacity significantly exceeds base demand. Additional base generation is not needed and ties up additional capital. Therefore, one needs to focus on the cost of adding (or saving) a kilowatt (Rs/kW) of capacity during peak demand time. We have evaluated various energy options according to life-cycle cost and first cost per kW added/saved at the bus-bar. This avoids placing emphasis on the addition of unnecessary base capacity. The table compares the options, ordering them by increasing life-cycle costs. The Rs/kWh costs are also shown although they are not relevant in the case of SSP since SSP provides maximum power during the monsoons when there is the least need for it.

Life cycle Costs and First Costs

The results of the analysis carried out by the author regarding life-cycle costs and first costs of various energy options is tabulated in the table on previous page. Details of the the analysis, and the assumption used can be obtained by writing directly to the author. The assumptions and the calculations are transparent and any body can understand and repeat them. The procedure allows for different assumptions to be made and the resulting costs can be computed directly. All results are given as values for the Western region except Refrigerator efficiency improvements, which are all India figures.

The above table demonstrates that SSP is one of the costliest option for meeting peak demand (only coal power is more expensive). (Nuclear is even more expensive but has not been included in the study—*Editor.* For the same investment as SSP, the total cumulative potential of these other options is approximately 65% more than SSP capacity and they can all be realistically achieved by 1998—that is just a year after SSP is scheduled for completion.

Life-cycle costing forms the core of this approach. All direct costs and credits are accounted for and brought back to their present value. Energy was treated in a similar manner. Where uncertainty was involved in the assumptions, conservative estimates were adopted.

For fair comparison, each energy option is replaced after completing its useful life while accounting for all costs over its life-time. The time horizon for this analysis is equal to the economic life-time of SSP, viz., 34 years. For reality, raw data for the study was extracted from the results of actual energy projects. Accounting for the higher availability factor of new generating plants scheduled by year 1997, it is likely that an overall availability of 64.2% will be achieved. This improvement is equivalent to a reduction of about 1,222 MW on gross generation (at bus-bar).

The first phase of extensive renovation & modernisation efforts have already improved plant performance equivalent to 1,400 MW of capacity nationwide. The resultant cost of saved capacity is only Rs. 0.87 crores/MW Continued efforts are expected to further improve the availability of existing plants. Despite this, the improvement has not been incorporated in the present study because of inadequate data. But, these favourable factors should relieve concerns about the desperate power shortages expected in the near future.

The following sections elaborate on selected DSM options that have proven themselves feasible, quick and inexpensive. Analysis reveals several key advantages of these options over SSP.

Irrigation pump Sots (IPS) Rectification

IPS consumption accounted for 22% of the total Western Zone consumption of electricity (in the year 1991-92). Work, especially in Gujarat (by the Gujarat Electricity Board and the Institute of Cooperative Management, Ahmedabad, demonstrates that 26% energy savings are feasible by simple low-cost rectification measures in IPS. Extensive field experience with IPS rectification has also accumulated. For example, as of 1991 the Institute of Cooperative Management rectifted 5000 pumps using measures which yield from 26-50% energy savings. This work was also taken **over by GEB, which comprehensive DSM schemes have been formulated which take into account technical, financial, and political barriers to IPS rectification.**

Ughtlntf Improvements

Lighting drives the peak load in India, comprising 34% of that demand. As a financially effective and proven means for demand reduction, energy-saving lighting should receive priority attention in energy planning. Compact-fluorescent lamps (CELs), comparable to incandescents in luminosity, use just one quarter the energy of their counterpart while affording many additional benefits. Energy analysis indicates that even with only 25% of the household incandescent bulbs replaced, CFLs have the potential for saving approximately 640 MW of peak power in Gujarat, Maharashtra, and M.P. In a span of 5 to 6 years, a well- planned program can achieve this saving at a cost of Rs.l3,800/kW (this is significantly less than the Rs/kW for SSP).

Refrigerator Efficiency Improvements

Indian refrigerators perform well below world efficiency levels. Remarkable efficiency improvements have been made in many countries. South Korea's refrigerators provide an excellent example for India to follow or even improve on. Over a 7 year period (1980-1987) the energy use of their 165 litre refrigerators dropped 65% from 672 kWh/yr to 240 kWh/yr. A 200 litre Damsh model now produced uses only 90 kWh/year. Refrigerator performances, but similar sized Indian refrigerator use about 540 kWh/yr. The large gap between good and bad refrigerator performance in different countries shows that there is significant room for improvement in India's models.

Currently more than 1.26 million units are produced in India and the production continues to increase at a rate of 10 to 12% per year. The refrigerator stock is expected to grow from its current level of 7 million units to approximately more than 50 million units by year 2010.

Simple modifications in the refrigerator design (refer to footnote for the specific modifications) can reduce consumption up to 24%. These modifications can be implemented immediately by developing an agreement with manufacturers. An overall cost increase of Rs 500/refrigerator is expected for these basic modifications. A delay of jut 6 yearn in implementing simple and immediate refrigerator efficiency improvements, will waste energy equivalent of over 40% of the SSP's production over 34 years of economic life time. These simple efficiency measures, provide an estimated saving of 34% in the refrigerator energy consumption. These measure are implementable in a short time, with immediate results. As seen in the above table, they produce large energy savings at a low cost.

Industrial Efficiency Improvements

The rapidly expanding industrial sector today consumes about 45% of the nation's total electric power.. Energy is a bottle-neck to industrial productivity today. There are many low-cost measures to reduce or minimise energy conservation through efficiency retrofit. The national energy conservation center in Pakistan, Enercon, audited 43 industrial plants. A 22% energy saving is anticipated using only measures with a 6 month payback time or less. Numerous energy audit studies done by the National Productivity Council and other agencies demonstrate similar savings in India.

China's success in industrial energy efficiency advancement is also

worthy of note. A huge energy efficiency program implemented at the central and local level between 1981 and 1985. Investments totaling 10 billion yuan were applied towards the retrofit of existing equipment and the installation of new energy -saving equipment. This efficiency outlay amounted to more than 10% of the total supply-side investment in 1981 and 1982. Since that time, the proportion of efficiency investments in virtually all highly industrialised and some developing nations, has increased substantially.

Other Efficiency Improvements

Reduction of Transmission and Distribution Lossos

There exists significant potential for reducing T & D losses, and increasing electricity availability (at the user-end) in Gujarat, M.P. and Maharashtra. A brief summary of the current situation is given below — Korea has been included as an Asian example of low T & D losses. Over the last 20 years, Korea's T & D losses of 25% decreased to just 6% with the aid of a straightforward four- component programme.

Gujarat	*21.7%*
M.P.*	*18.9%*
Maharashtra	*16.0%*
Korea	*S.7%*

Average Transmission & Distribution Losses

- Reduction of existing line loads to 75% of their rated capacity
- Addition of needed conductors to accommodate residual load;
- Installation of low-tension and high-tension capacitors to increase power factor levels;
- Utilisation of low loss equipment i.e. current transformers.

As a result of these measures, Korea's transmission and distribution efficiency now betters the US. by approximately 2%.

Fortunately, methods for reducing technical T & D losses are straightforward and do not require any advanced technologies. T % D improvement investments are frequently more cost-effective when compared to the cost of new installed capacity. A World Bank study in Sudan demonstrated that an outlay of Rs. 3 crore for static capacitors would yield a generation capacity savings of Rs 6 crore. The retrofit was intended to correct low power factors in the distribution network, a problem that is common in India.

Maharashtra's T & D system has improved significantly since its high of 17.6% losses in 1989-90, falling to 15% over the 1991-92 period. This encouraging trend is the result of recent loss reduction efforts by MSEB is still under—way (further reductions are expected). Gujarat and M.P. enjoy even greater potential for improvement with their present high T & D losses. The present allocation for T & D investments which is approximately 34% including outlays for lines and equipment, is quite low relative to the 45-55% expenditure of other countries. To gain the benefits of this environmentally benign resource, a larger proportion of the power sector budget — even more than for capacity expansion — must be allotted towards this resource.

Power Plant Tune **up**

De-rating of power plant capacity and low plant load factors (and plant availability) are common features of the power sector in India (and other developing countries). A1989 World Bank survey of 70 developing countries shows an extra generating capacity of 43 gigawatts (at a cost of about Rs. 150,000 crores) resulting from excess reserve margins due to the features mentioned above. A 1991-92 Economic Intelligence Service study of India reveals an average plant load factor of only 55.3%, demonstrating that existing capacity is significantly under-utilised.

Pakistan has experienced similar problems. A rehabilitation project now under way in Pakistan is designed to restore the original ratings of 15 steam and combustion turbine units providing an additional capacity of 120 mega-watts while halving the forced-outage rate. These benefits are derived with pay-back times ranging from 2 months to two years.

Thermal plants in the three states involved in the SSP realise only a 52.8% Utilisation rate, whereas 70-80% plant capacity factors are typical in other countries. Many opportunities for capacity improvement are available. Some older Indian thermal units have boilers which are not even configured to operate on high-ash coal, the primary, thermal fuel. While it is true that high ash coal use requires some additional maintenance, analysis indicates that in most cases maintenance is considerably more economical **than** equivalent new installed capacity.

A continued effort directed **towards** renovation and modernisation **to** improve the availability of **coat-baaed** thermal plants is now in **progress in**

Inda. In the first phase of this, an investment of Re 1,223 croree is expected to improve plant performance equivalent to adding 1,400 MW capacity (all over India, Rs 0.874 crores /MW of saved capacity). This process is expected to continue in the second phase and will improve availability of old plants above the 1992 level. A preliminary estimate indicates that this will be equivalent to a capacity saving of 1,600 MW (all India). The on going R&M for hydro power stations is expected to save another 846 MW capacity nation-wide.

Since this huge economic resource is in the process of being tapped, it has not been included in the present analysis as an alternative to SSP. But, it must be stressed that demand forecast studies have not recognised the reduced need for capacity additions because of these ongoing measures.

Tims off day Tariffs and Load shifting

Many State Electricity Boards are actively thinking of introducing/strengthening Time-of-day (TOD) metering and two-part tariffs. This strategy encourages energy consumers to shift their load to off-peak hours using a variety of incentives including time-specific tariffs. Once the realistic cost of peak-time energy and off-peak-time (night time) energy is charged to the industrial consumers, sufficient incentive exists for them to alter their usage patterns. A survey of HT industries in Western Maharashtra has estimated that about 2.0% of the normal HT load can be shifted from peak to non-peak hours by managerial solutions, and 0.6% by staggering the timing of industrial operations. An additional 3.0% of the load can be shifted if some investments are made. This amounts to about 400 MW in the western Region by 1997. These measures art typically less costly and more rapidly implemented than capacity addition.

ENVIRONMENTAL & SOCIAL IMPACTS OF THE OPTIONS

Concern about the social and environmental costs of power generation has been increasing world-wide. Whether the source is Urge hydel, coal thermal, or nuclear, experts now recognise that the social and environmental consequences of power generation are large, Usually, these consequences are borne predominantly by the most deprived sections of society.

A kilowatt-hour saved is a kilowatt-hour made?

No!

A kilowatt-hour saved is equivalent to more than 1.29 kilowatt-hours generated at 22.5 % Transmission and Distribution losses.

Environmental Impacts

The environmental impacts of SSP are known to be large, but their over-all effects have not yet been determineil. In the present study, therefore, alternatives to the dam were selected based on their cost and socio-enviroamental soundness. For example, efficiency improvement measures such as T & D loss reductions. IPS rectification and efficient lighting, use neither consumed fuel nor submerge land—their environmental impact is virtually negligible The first cost and life-cycle cost of these measures are also lower than SSP. Pumped-etorage generation typically uses energy supplied by coal plants. Hence the concerns related to coal combustion would also apply to this form of'hydel'generation. This concern also applies to the pumped-etorage mode of operastion at SSP. However the alternative pumped-etorage schemes have every limited land requirements and consequent submergence.

Gas turbine thermal facilities enjoy many environmental benefits over coal thermal plants. Natural gas used in the turbines i» the clennest fossil fuel source. Also, there is little associated thermal pollution and sulphur emission from CCGT plants relative to coal power.

Cogeneration reduces sugar factory emissions because of the higher efficiency of combustion attained. The production in some cased divert bagasse, which can otherwise be used for making hard-board or an biomass. Fortunately, this quantity is disproportionately small compared to the generated power.

Social Impacts

The most adverse social impact of power generation is the displacement of people. The degradation of land and water resources also add to this impact. In comparison to the SSP, the land requirements of the alternative optionn are negligible, and the displacement problem is minimal.

CONCLUSIONS

The economics of the alternative energy options (excluding coal-based thermal power) are markedly superior to that of SSP. The achievable power potential is also many times the potential of SSP Finally the alternatives provide greater environmental and social compatibility and therefore greater societal acceptance. This is a very important bonus in favour of the alternatives apart from their lower financial cost.

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Kaiga left High and Dry

Ommissioning of the Kaiga Atomic Power Plant will be delayed because of a serious crisis in cooling water supply, according to the project authorities. The delay would be inevitable if the dam promised by the Karnataka government across the Kali river did not come up soon, they said.

"Non completion of the dam is the single major hurdle we are now facing," said Mr. Paramahamsa Tewari, Kaiga project director. He said the delay in commissioning of Kaiga would cause monetary loss of Rs 1 crore per day to the Nuclear Power Corporation (NPC).

The atomic power station requires several million gallons of water per hour for cooling and this water is supposed to be drawn from a reservoir created by the 36 meter tall dam to be built at Kagra, a few kilometres from the project site. The plant authorities said that the state-owned Karnataka Power Corporation Limited had agreed to complete the dam in June this year, but the construction work which was suspended ten months ago has not been resumed yet. "The water intake structure and the pump house at the project site are almost ready, but there is no sign of the dam coming up and we may face a crisis in cooling water," said Mr. V. Raghavan, chief construction engineer of the project.

He said that as a contingency measure, water from the river could be directly pumped to the reactors at the time of making the reactor critical. After that the plant will have to be shut down.

NPC officials said Kaiga site was selected because of assured availability of water from the Kali river hyde1 power scheme that envisaged construction of a series of dams in* eluding the one at Kagra.

Withdrawal of the World Bank aid for the scheme and an unresolved dispute between KPCL and its contractor over revision of rates are said to be the reasons for work stoppage at Kagra dam. Mr. Tewari said the NPC chairman has taken up the matter with the Karnataka authorities and hoped that the dam would be completed without further delay.

Meanwhile, workers yesterday (1st February, 1994) poured the last bucket of concrete on the dome of unit-1 of Kaiga signaling the completion of almost all the civil works of the first of six 235-mw reactors in the midst of a jungle, 35 km east of the scenic Karwar coast.

Mr. Tewarisaid subject to the availability of coohing water, unit-1 will be ready to deliver power from June 1996 and the second unit will be commissioned six months later.

"Soil investigations for two more reactors (unit-2 and 3) are already on," according to Mr. N. Rajasabai, station superintendent of the project who dismissed as "baseJess" reports that KAPP hud uprooted people and destroyed virgin forests. We cut 10,000 trees but have already planted 150,000 saplings elsewhere and the entire project required shifting of just 85 families," Mr. Rajasabai said. All the displaced families have been given houses in Karwar "and one member from each family has a job at KAPP," he said.

According to Mr. Tewari only 50 hectares of forest land had been used by the project so far, and another 70 hectares will be taken up when all the six reactors are built In contrast he said, the Kali river scheme for generation of 1400 MW "will submerge 100 times more forest area."

Mr. Tewari said environmental clearance for the four additional reactors had already been obtained and soil investigations were on. He said Rs 650 crore had so far been spent and the cost of the project was being revised upwards.

Mr. Tewari said Kaiga reactors are the first to have "a massive structural concrete wall" that acted as a third barrier against any leak and added to inherent safety. Power reactors elsewhere in India have only two concrete walls.

Newsreport in Times of India February 2, 1994

Editor's Note:

I found the most interesting part of the report to be the information about the nuclear authorities' willingness in case the dam is not built, to just make the reactor critical and then to shut it down. What this action would do is that it would ensure the bonuses for quick construction to engineers and construction workers, though the plant would not produce any electricity. It would also pollute the reactor irremediably. This contemplated action illustrates the 'patriotic' priorities of our nuclear establishment rather well.

Also I found Mr. Tewari's comment about the submergence caused by the dams to be very funny Here the man says just a second before that if the dam is not built the nuclear plant would have to be shut down, and yet he does not consider the submergence due to the dam to have any relation to the power plant Such blinkered vision is indeed characteristic of nucleocrats.

No.3

Environment Versus Development

Amulya K N Reddy

The debate between 'economic development' and environmental welibeing is being conducted in many parts of the world. It is of special relevance to the Third World. In the following, Professor Amulya Reddy puts the argument with special reference to India in the form of a dialogue between an Earth Protecting Mother (EPM) and a Growth Promoting Father (GPF). It has often been the contention of the nuclear lobby that while environmental considerations may be all right for the developed countries they are a luxury' for a poor nation, which is trying to 'catch-up with the West Dr Reddy shows not only how it is possible, but also why it is necessary to protect the Earth.

EPM: All over the world, the growth of energy use is leading to rapidly increasing environmental degradation. Local and regional habitat is being ruined by urban atmospheric pollution and acid rain. Accumulation of greenhouse gases in the atmosphere has raised the spectre of global warming and an uninhabitable earth.

QPF: Don't lay the blame for the increase in greenhouse gases on developing countries like India. This increase was caused predominantly by the industrialised countries through their voracious appetite for fossil fuels to generate electricity and run their vehicles. Even today, they contribute 58 per cent of the annual carbon dioxide emissions.

EPM: That is true, but even if the industrialised countries stabilise their emissions, India and other developing countries will-if they pursue present patterns of energy consumption-produce significant increases in concentration of greenhouse gases.

GPF: All this talk of global warming is only a tactic of the industrialised countries to divert us from our mission of development. The fact is that India is only a minor contributor to the global atmospheric changes—it accounts for only about *2.5* per cent of the total annual carbon dioxide emissions into the atmosphere. Acid rain is largely Western problem. Environmental degradation brought about by energy projects in India is negligible and not worth worrying about.

EPM: Not so! Our hydroelectric projects have been responsible for submergence of prime forests, the displacement of people from the submerged areas, their resettlement after deforestation in the catchment areas of reservoirs and the resulting soil erosion In Karnataka, for instances 42 per cent of the 203,913 hectares of prime forest lost between 1956 and 1984 has been due to power and irrigation projects. As for coal-mining, it devastates the countryside. Anyone who lives near coal-based thermal power plants knows the tremendous atmospheric pollution that they produce.

GPF: If there is to be progress, we cannot avoid the environmental consequences of energy consumption. After all, development requires economic growth which in turn depends upon the consumption of energy. India requires massive increases in the consumption of energy in order to promote development and ensure progress.

EPM: Do not equate development with growth (in the volume of goods and services). Whether socio-economic change is to be deemed as development or not depends upon what goods and services constitute growth and which sections of society benefit from these goods and services. Mere economic growth that does not result in ihe satisfaction of basic human mods (starting with the needs of the neediest!) is a mockcry of development.

GPF: But, you must admit that the standanl of living in a country depends upon its per capita enorgy consumption (PCEC). Peopic like you who oppose major increases in energy consumption are in fact preventing improvements in the standard of living.

EPM: Your view, which is indeed conventional "wisdom", is being challenged more and more because it treats energy as an end in itself. In fact, what people need its not kilowatt hours, tonnes of coal and barrels of oil but illumination, warmth, transportation, etc. Energy is only a means to the end of providing services, performing useful tasks and satisfying human needs. Hence, the true meaaure of development is the level of energy services (the amount of light, heat, motive power, etc) and the distribution of energy services (which determines who are the beneficiaries of energy). In order to advance development, the level of services must be increased and the poor must be the principal beneficiaries of energy supplies. For, it is this level of energy services that determines the quality of life and the distribution of services that reveals whether basic needs of the neediest, are being satisfied.

GPF: All that is obvious! The point is, how can the level of energy services be increased without increasing consumption of energy?

EPM: Energy services are provided by end-use devices (stoves, furnaces, lamps, motors, engines, etc.). The level of energy services depends, not only upon the magnitude of energy supplied to end-use devices, but also upon the efficiency with which the devices convert these inputs into useful energy. Hence, increases in the level of energy services can also be achieved with efficiency improvements. One gets twice the illumination with half the consumption of electricity by switching from one inefficient 60 watt incandescent bulb to two efficient 15 watt compact fluorescent lamps.

Are no further Increases In energy consumption necessary In India?

EPM: What is being suggested is that if opportunities for efficiency improvements are systematically identified and exploited, the magnitude of energy demand can come down very sharply. In that situation, energy supplies need not become a constraint on growth and many grandiose centralised energy supply projects become unnecessary. As Gandhi said: "The world has enough for every man's need, but not enough for everyone's greed!"

GPP: Even if energy conservation can achieve a great deal in the present context, India's growing population will compel rapid increases of supplies.

EPM: Supply increases can be minimised! It has been recently estimated that
1) even if India targeted for a level of energy services or activities corresponding to Western Europe in the 1970s (not that such a target is necessarily desirable!), and
2) if the country used for s.ll these activities the most energy-efficient technologies that nre commercial today or near commercialisation,
the Per Capita Energy Consumption would only have to be some three times greater than it was (including biomases energy) in 1978. Hence, efficiency improvements are the silver lining; they radically improve the prospects of achieving significantly higher standards of living: in the country. They may also lead to lower population growth rates since growth rates are generally reduced by improvements in the standard of living.

GPF: Your argument may well be valid for industrialised countries where the PCEC is so high that there is tremendous scope for energy conservation. But, the situation is totally different in a poor country like India where the PCEC is low and there *it* little room for energy conservation.

EPM: You are making the common mistake of confusing conservation with a decreased satisfaction of basic needs. The real thrust of conservation should be towards efficiency improvements. Energy is used very inefficiently in all sectors of the country's economy. Indian industry is largely based on energy-inefficient designs/equipment imported from the industrialised countries during the era of cheap energy. Thus, there are tremendous opportunities for energy efficiency improvements.

GPF: You are misleading us. In the late 1970s and early 1980s, the industrialised countries reduced their rate of growth of energy consumptibn by moving away from energy-intensive industries. But, our country cannot make these structural shifts because it has to industrialise. So, India can't reduce energy consumption in the same way as the industrialised countries.

EPM: Fortunately, India need not find it as difficult to modernise as the industrialised countries because its stocks of equipment are not as large. Hence, we can exploit more easily new technologies that permit dramatic improvements in industrial energy efficiencies. The industrial sector in India is an ideal environment for technological leap-frogging to an energy efficient future.

GPF: That may be, but what can be done about the biomass energy sources (fuelwood, agricultural residues and animal wastes) that account for a large fraction of energy consumption in India?

EPM: Most of this biomass is used in the residential sector for cooking in traditional ways at very low efficiencies. By moving to efficient sources/devices for cooking, the country can release enormous amounts of biomass to establish a major base for renewable energy sources (biogas, producer gas, ethanoi and methanol). Bioraasa-baeed devices such as gasifiers and gas turbines can then play a major role.

QPF: You admit that a given level of energy services can be achieved without changing the present stock of energy-utilising devices —however inefficient it may be—by increasing the input of energy. If so, why are you so much against increasing rate of growth of energy supplies?

The economic argument for reducing ratio of energy to GDP growth rates

EPM: There are powerful economic and environmental reasons for reducing as much as possible the ratio of the growth rate of energy to the growth rate of GDP. Current planning norms used by developing countries assume that the electricity growth rate should be about twice the growth rate of the GDP. To achieve such a growth rate in electricity supplies, astronomical investments are required.

The World Bank recently reported that the developing countries have asked for about $100 billion peryear to pursue current patterns of electricity generation and consumption when only about $20 billion would be available as aid. And India's Eighth Plan proposals demand an expenditure of about Rs. 100,000 crores to increase the electrical capacity by about 38,000 MW. Without* clear idea of where all this capital is going to come from, what is being proposed is absurd. It only proves that present patterns of energy generation and consumption are impossible to sustain from even an investment point of view.

Sustainability requires that the annual bill must be decreased by reducing the coupling between energy and GDP. We must lower the electricity-GDP ratio and get more GDP for lees energy. This can be achieved by efficiency improvements in energy production and consumption. The experience in many countries is that saving a unit of energy is one-third to one-half as cheap as generating it. Efficiency improvements also reduce the unit investment cost (Rs/kW) and the investment bill.

How will reducing the energy-GDP ratio help the environment?

EPM: The alarming increases in energy production and consumption are leading to environmental impacts that are quite serious. Many hydroelectric projects cause the submergence of forests as well as soil erosion in the catchment areas, and waterlogging and salinity increases in the downstream areas. And, coal-based thermal power plants are a major cause of atmospheric pollution.

GPF: You are presenting it as if there are no other supply options. But, there are clean energy sources. You must accept, for instance, that nuclear power does not lead to forest loss. It does not pollute the atmosphere with particulates and emissions that cause acid rain. It is non-polluting as far as carbon emissions and the greenhouse effect are concerned. In feet, it is the answer to both local environmental and global warming problems.

EPM: Don't forget the accident at Chernobyl that polluted vast areas of Europe. As long as we cannot conceive of all the ways in which reactor accidents can occur, we cannot rely solely on automatic safety mechanisms. And the moment we permit operator intervention, we cannot avoid some fool doing a foolish thing. Nuclear power is too unforgiving a technology.

GPF: Maybe the present generation of reactors are unsafe, but don't ignore the exciting developments that are taking place in nucl«>ar technology. Inherently safe reaetors are being designed and will soon be available.

EPM: But, reactor safety is only one of the problems with nuclear power-and in fact, not the main problem. Nuclear plants produce high-level waste which create long-term disposal problems that have not yet been solved. In addition, there is a very close link between nuclear power and nuclear weapons. This link to either direct through the use of power generation as a starting point for weapons production or indirect, through the theft of weapons-usable material. Nuclear power, therefore, is not the answer if we want to save the world, not only from environmental degradation and the potential dangers of global warming, but also from nuclear destruction.

In any case, using less energy is the best way of reducing the impact on the environment. Conservation technologies are the most environment friendly followed by decentralised technologies based on renewable sources of energy (mini- and micro-hydroelectric, btogss and producer gas, gas turbines, solar water heaters, etc. and in the near future, photovoltaic devices).

What must India do?

EPM: India must for economic and environmental reasons, adopt a new set of national priorities that are derived from the objective of need-oriented, environmentally sound and self-reliant development. This development focus determines how benefits

of energy are distributed between sections of society and the extent to which the quality of life of the poorest is improved. Energy planning must acquire an end-use orientation that emphasises energy services rather than energy consumption and take the opportunity for efficiency improvements through new energy technologies.

Whether it is new energy carriers or new end-use devices, there is a tremendous scope for basic research, technology development and innovation which means that Indian science, technology and management have to play a central role. In development oriented to basic needs, the stress has to be on the poor as beneficiaries—this means that scientists, technologists, managers and the people have to work jointly to build the new energy systems of the future. Such a development-focussed end-use-oriented (DEFENDUS) approach makes India's energy future a matter of choice; today this future is viewed as destiny because of present trends.

As a side-effect and a bonus, this approach will prevent the country's energy system from aggravating the global problem of greenhouse gases.

Hope for the new future

EPM: Thus far, the industrialised countries and the Indian elite have colluded in promoting a pattern of growth that is economically unviable, environmentally damaging and golbally disastrous and unsustainable. Now, the industrialised countries are realising that further promotion of these growth patterns can make the earth a veritable hell. Therefore, the industrialised countries might have a stake in sustainable development as a way of protecting the global atmosphere. This is the good news!

GPF: Sustainable development, with its emphasis on the needs of the neediest, may well lie in the interests of the Indian masses. But, it is not in the immediate interests of the lobbies associated with current energy patterns. These lobbies will put their own vested interests above the interests of their masses, of sustainable development and thereby the global climate. Thus, it is very likely that there will be a head-on collision between the Indian elite and the industrialised countries. The elite will talk vehemently about the development versus golbal climate dilemma. And in this context, the resolution of the dilemmas through energy-efficicient futures will not be implemented. Instead, India will continue to be used for the promotion of economic growth and its wretched population will be condemned to adapting willy-nilly to environmental degradation. The custody of the country should remain in the hands of pragmatists who recognise this reality.

EPM: There will no doubt be tremendous opposition to the energy-efficient future that advances sustainable development. But, however difficult it may be to achieve such futures, the fact is that the present growth-obsessed trend is impossible to sustain on economic grounds. Custody of the country should be given to those who will ensure a sustainable future in which people will flourish!

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The Great Power Scam

Why Foreign Deals Must Be Scrapped

The government has embarked on a dangerous course in the vital electricity sector. Desperate to attract foreign investment, it is offering incentives and terms that are wholly iniquitous and do not even make commercial some. If these projects go through, India will soon have unaffordably expensive, gold-plated power, greatly increase its dependence on imports, cause a huge outflow of foreign exchange and destroy its own equipment-manufacturing sector, besides rendering many industries hopelessly uncompetitive.

If this sounds like an exaggeration, consider the following. The power ministry is about to clear 66 private proposals, including 36 foreign proposal, to invest Rs 88,000 crores in 28,000 Mw. of power (an addition of two-fifthe to the existing capacity) by offering a 16 par cent rate of return and a plant load factor

of 68.5 percent. The price to be paid will cover foreign exchange fluctuations and include guarantees on bilateral loans as well as payments by state electricity boards(SEBs).

Unheard of

Such terms are unheard of anywhere in the world. Typically, the projects in question have a capital cost of Rs 30,000 to 44,000 per kw. which is way above the Eight Plan working group norm of Ra 16,000 to Rs 20,000. They will generate electricity at more than double the present national average cost of Re 1.24 per kilowatt-hour. They also involve an adverse energy, material and foreign exchange balance.

The unseemly haste with which such "white elephant" projects are being pushed through by Union power ministry and some SEBe is exemplified by the manner in which the Central Electricity Authority was recently bullied into clearing five proposals, involving over Rs 13,000 crores, in a single day.

The government has bent over backwards to court foreign firms by offering rates and guarantees which it denies domestic industry; it has also waived debt-equity norms and raised depreciation rates and other terms to a point where the investment carries no risk whatever.

The starkest example of these ill-conceived projects is Enron's at Dabhoi in Maharashtra. This Rs 9,053 crore venture will generate 695 MW by burning imported distillates in the first phase (Rs 2,900 crores), and adding 1,320 MWand converting the whole capacity to liquefied natural gas, in the second. The capital cost works out to Rs 44,000 per kW, compared to under Rs 10,000 for two recently completed BHEL projects (Singrauli and Ghandrapura).

The price to be paid by MSEB to Enron is designated in US. currency in a bixarre form of globalisation: 7.47 cents or Rs 2.39 per kWh. An energy economist, Dr Kirit Parikh, **calculates after taking into account transmission and distribution losses and price escalation that industry will end up paying as much as Rs 4 per unit for Enron's power! This is four times higher than the average rate the Indian consumer pays, and will raise Maharashtra government's deficit to unconscionable levels.**

The whole proposal is so outrageous that even the World Bank has refused to finance it. Dr Parikh estimates that Enron will cause a foreign exchange outgo of between Rs 2,000 crores and Rs 9,000 crores. Besides, it will enforce continuing dependence on an expensive, foreign, petroleum-based resource. Another estimate shows that MSEB will lose Rs 2,000 crores on Enron deal even if it doubled its tariff. On the other four recently-approved projects, the loss at current tariffs would be Rs 4,500 crores.

Mind BotfUng

These are mind-boggling numbers by any standard. They simply spell ruin for the power sector and for Indian industry. Evidently what is involved here is padding of capital costs, an internal rate of return of 30 per cent, exaggeration of (fuel and material costs, and other ingredients of a gigantic scam.

These projects will also effectively destroy a number of Indian manufacturers of power generation and transmission equipment, themselves a major component of the critical capital goods sector. Contrary to propaganda, these are among the most competitve comapnies anywhere. They include BHEL, which World Bank regards as "one of the most efficient enterprises in the industrial sector," for which the effective protection rate Is close to cero" and whose products are on a "par with international standards".

BHEL has already been brought to its knees through systematic discrimination. It will perish if starved of orders. This is true of a number of Indian public and private enterprises as new projects are monopolised by foreign firms which face a domestic recession and have huge unused capacity.

Is there an alternative to such unaffbrdable and irrational power-purchase projects? There clearly is. Even on the extravagant assumption that the demand for power will annually grow at 6.5 per cent, that capacity will have to double in 12 years, and that the public sector will not be able to build more than 2.000 MW a year, it should still be possible to effectively create or save 50,000 MW. Mr R.D. Agha of Thermax Ltd. calculates that, by refurbishing, better maintenance and life extension of existing power plants; by cutting T & D losses by 10 per cent; by using co-generation; and by reducing sheer waste of power, India could save 47,000 MW.

No End to Irrationality

The irrationality does not end here. Once a precedent is set for a cost-plus, 16-per cent-return formula, foreign—and Indian — firms will demand similar terms in telecommunications, oil or fertiliser—with disastrous economic consequences.

So for as power goes, the government has created a scare by making wild demand projections and proceeding to court foreign investors on scandalous terms, with no consideration for the exchequer or for industry. The whole approach represents a retreat from the urgent task of reforming the electricity sector.

There must be more than a policy error here. Given the sheer magnitude of the deals being made, it would indeed be a miracle if no slush funds were involved. It is a fit case for a parliamentary investigation.

PrafulBidwai
The Time* of India December 29, 1993

Vested Interests Push Thailand Nukewards

India Offers Research Reactor

Energy Committee of the Thai Parliament expressed strong determination to push for nuclear power development in the country. The chairman of the committee, Rawi Kingkhamwong said that nuclear power was an option for the country. He lamhasted the House Committee on the Environment for its opposition to nuclear energy, calling the committee's information insufficient. "Many countries are very successful in developing nuclear energy. How come the committee on the environment chose to look at the countries that failed?"

Wiwat Plueksawan, assistant direct of Electricity Generating Authority of Thailand said that siting of Thailand's nuclear power plants would be finalised within this year and it would take two to three years before a decision on nuclear development would be made. From more than 100, the number of sites has already been narrowed down to five and it is quite certain that the power plants will be located in the southern part of Thailand, he said. The southern region has a high potential for nuclear power development as it lies close to the sea, which means ample water is available, he noted. Mr Wiwat said, however, that public acceptance was the most significant factor as to wheiher the country goes nuclear or not.

India has offered to export to Thailand a nuclear research reactor under the safeguard of the International Atomic Energy Agency.

Bangkok Pott
January 26,1994

| Letter Box

I was shocked reading news of nuclear cooperation between Thailand and India. The worst thing is that the nuclear center research reactor will be built at the place which is just 10 km. from where I work. They are now just under our noses.

Recently, one of the Canadian nuclear companies came to present their project to the Thai army. Nuclear companies know that soldiers will be their good supporters. They know that if any important decision needs to be made, the army is the next most influential force after the king. They understand us well enough.

We are now trying to raise a campaign against this reactor and also against nuclearisation of our country. We need to collect information on the issue. We dont know much about nukes. Only handful of people have a real understanding.

We would like to request that you send us books on the issue which you think would be useful for us. Please send us also information regarding the Indian use of nuclear power. Or, if you can write the articles on "Lesson from Indian Nuclear Power", it will be tranlated into Thai and then published.

We would also like to request other antinuclear groups to help us with information.

Eddie'

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Fairy Tales From Anuland

The Toddler And The Toy

Once upon a time, the Toddler had a toy. Toddler loved his toy. The toy made Toddler feel big and important. Allthough you could not taste it or see it or feel it or smell it but it glowed in the dark. You could play with the toy in many different ways. It gave you energy and if you zapped the boy next door with the toy he stayed zapped forever and ever. Yes, the toy was lovely.

Some people said the toy was useless. It was costly. It was dirty. It did not work more than half the time. It was carcinogenic and caused genetic deformities in children. And God forbid, if the toy was ever to blow up, heaven alone knew what damage it would do. It was no toy for a small boy or for anybody else for that matter. Such toys should be banned these people said.

But Toddler knew that all these people were just jealous of Toddler's wonderful toy. Any way these old fogies lived in a world of their own far away from Anuland. And they talked nonsense all the time. Like one should love one's neighbour. Ha! Toddler hated his neighbour Never mind they were brothers once. That was long a go. This upstart kid next door was quarreling with Toddler about the ownership of the swing. Everybody knew that the swing was an inalienable part of the Toddler home and no power on Earth could remove it. But that sneaky creep next door was up to all sorts of tricks. He was secretly making a toy of his own. And he kept shouting that if

Toddler did not give him the swing, he would zap Toddler.

The toy gave you power. Everybody respected you. All the big boys had toys of their own. In fact, unless you had the toy, you were nobody. Even the infants wouldn't look at you with respect. And Toddler wasn't small anymore. He may be poor but he was big. Being poor was terrible. You had to beg for toffees from Big Brother and the other big boys who lived on the West side. But as far as the toy was concerned, Toddler was self-reliant. Nobody could bully him.

Big Brother had made the first toy And then the second toy And the third. And .... He had made them bigger and smaller and safer and deadlier. He had built so many of them that now the whole house was full of toys. In fact, the whole of Anuland was full of toys and there was no place left where you could forget about toys and play in peace. Making toys was not easy It required brains and yellowcake. Yellowcake made everything yellow, and you couldn't clean the stuff. His whole house had 43,300 spots of yellow. But what could he have done? There was that evil red bully (of course they were buddies now and the red bully was not such a bad guy once you knew him especially when he came begging on his knees for a toffee to Big Brother—no, not a bad chap at all).

But in the old days if Big Brother hadn't built all his toys and stayed a stepabead of Red... But all that was old history now.

Big Brother was worried. All these pesky little jerks with toys. They would surely blow up one day. And if the toy were ever to fall in the wrong hands ... Well, they had all made the deal. He had got everybody to agree that only he and the rest of his gang would be allowed to zap with the toy. Everybody else could play with the toy but they had to promise, a real cross your heart and be allowed to die promise mind you, that they would never ever try to use the toy for zapping. If they promised and behaved properly and traded all their toffees for the toy, then Big Brother or somebody else from the gang would make a toy for you and teach you how to play with it and even build one for youself. But if you ever tried to break the promise, remember the runt. The runt lived in the middle of the street. He had remised but had been double-crossing them and was secretly building a toy for zapping. Well Big Brother had shown him. 'Let that be a lesson to youall. Anybody who falls out of line better watch out. Big Brother is watching you.

The trouble was, that Toddler and the upstart kid next door had not agreed to the deal. They had their toys and kept threatening each other with zappping. Three time during the last ten years, Big Brother had had to step in and break up the fight. The last time it had been quite touch and go. If Toddler wasn't put in his place then what about the others. Nobody would listen to Big Brother any more.

Sleep well, my princess, I will read you the rest of the story tommorow. You have nothing to worry. Anuland is far away and this is a fairy tale. If only real life were so simple.

Surendra Gadekar

from the Editor's 'Desk

AERB Chief Visits Vedchhi

Relations between antinuclear groups and the nuclear establishment in India over the past many years have been cold, even frigid. This is in sharp contrast to colonial times when the intercourse between nationalist groups and the British rulers though hostile and confrontational was also marked at times with mutual personal admiration and even friendship. Nucleocrats in India have thought of antinuclear activists, if they thought at all, either as well meaning but hopelessly deluded and irrelevant Gandhian cranks, or as foreign inspired and funded busybodies who were a hinderance to the task of 'nation building'. Antinuclear activists have reciprocated this contempt and have thought of nucleocrats as self-serving sycophants with no compassion for the people. It is a situation where there can be no dialogue.

The few occasions where the two have come face to face have been public platforms most notably the "National Workshop on Nuclear Energy" in Bangalore in December, 1988. At these events, both sides have tried to put their point of view across to the public but have not tried to build bridges towards each other. The upshot of these debates has been that the nuclear establishment has realised that they are on a very sticky wicket in open public debate and has avoided such fora ever since. They have instead, with some success attempted to influence public opinion by trying to 'buy-off opinion makers around nuclear power plants. Also, they have bombarded TV, radio and large circulation print media with 'documentaries' and paid advertising.

Dr A Gopalakrishnan, the chairman of the Atomic Energy Regulatory Board, has taken initiative in trying to break the ice. He met Professor Dhirendra Sharma in January and visited us at Vedchhi in February. Unlike the previous occupants of his chair, who came determined to 'allay our fears', he came alone and spoke with refreshing candour. He wanted to understand the Rawatbhata survey and asked many questions regarding that. He proposed arranging periodic (once every three to four months) meetings with antinuclear activists and 'knowledgeable' journalists, so that "various issues can be discussed across a table and a mutual understanding can be built."

Compared to the sterile stalemate of the past few years, this position does offer some interesting possibilities. It is also fraught with the danger of co-option. Entry to previously inaccessible information and dialogue can if one is not careful lead to 'self-censorship' and a muting of criticism. Also, these across the table discussions cannot be a substitute for open public debate which are the most effective means of educating the public on nuclear issues. Therefore, I would like to hear what you, dear reader, have to say on the issue and invite your opinion regarding the basis on which we should proceed. This would help in another way: I will, for a change, have some letters to publish in the letter-box.

I must humbly apologise for the disaster of the October / November '93 issue where due to an incompatibility between the fonts used in my computer and the printer's, the formating had gone haywire.

Disposable Citizens

"A new nation conceived in liberty
and dedicated to the ideal that all men are created equal"

The door to a secret chamber of nuclear horrors is slowly being prised open in the United States, revealing government-ordered radiation experiments on retarded children, pregnant women, and convicts and a range of other clandestine atom-age projects which have shocked and frightened the American public.

The steady drip of newly released records from the department of energy, the agency which has overseen America's military and civilian nuclear complex since the dawn of the nuclear era, has suddenly turned into a torrent. Collectively, the records conjure up a nightmarish picture. They show how successive administrations, determined at all costs to keep ahead of the Soviet Union in the nuclear arms race, repeatedly and illegally placed thousands of unsuspecting Americans at serious and lasting physical risk.

The government's human experiments, undisclosed atomic weapons tests and deliberate radiation releases over populated areas began in 1945 after the atomic strike on Japan in August of that year. In some cases they have continued almost until the present day. They remained hidden for so long because of what Hazel O'Leary, President Clinton's new energy secretary calls a culture of deception.

"We were shrouded in an atmosphere of secrecy," Ms O'Leary said recently "I would take it a step further. I would call it repression."

Having taken control of the Energy Department early last year Ms O'Leary has been clearly shocked by what she found in its archives. In an unprecedented move, she ordered the review of an estimated 32 million secret documents for possible declassification. Many have already been released. She also ordered a sweeping investigation into the radiation experiments on humans. Then Ms O'Leary took another extraordinary step for a senior government official. She said compensation for victims of the atom age programmes would have to be considered.

"My view is that we must proceed with disclosing these facts and information regardless of the fact of whether it opens the door for a lawsuit against the government. We ought to go forward and explain to the Congress what has happened and let Congress and the American public determine what would be appropriate compensation," Ms O'Leary said. For America's defense establishment, it is as if a whistle blower has suddenly become the boss.

So far, the department of energy records and related research by congressional and journalistic investigators have brought the following US government projects to light:

- **At least 19 mentally retarded boys were fed radioactive milk mixed with cereal in experiments conducted by scientists from Harvard and the**

> *"We were shrouded in an atmosphere of secrecy. I would call it a culture of deception. My view is that we must proceed with disclosing these facts regardless of the fact of whether it opens the door for a lawsuit against the government. We ought to go forward and explain to the Congress what has happened and let the American public determine what would be appropriate compensation,"*
>
> ***Ms. Hazel O'Leary***
> ***U.S. Energy Secretary***

Massachusetts Institute of Technology in the 1940s and 1950s. The experiments, funded by the Atomic Energy Commission, were not fully explained to the boy's parents. They were told, in a letter that, we are considering the selection of a group of our brighter patients, including your son, to receive a special diet. The boys were told they were participating in a science club.

- About 800 pregnant women were dosed with radioactive iron in a government -backed experiment at Vanderbuilt university in Tennessee in the late 1940s. The objective was to study the effect of radioactivity on fetal development. A follow-up study found a higher than normal cancer rate among the women's children.
- In experiments conducted in jails in Oregon and Washington states, the testicles of more than 130 male inmates were exposed to high levels of radiation from X-ray machines. The prisoners were paid for their trouble, but according to Robert Alvarez, a senior aide to Ms O'Leary, the risks were not fully explained to them. "These prisoner studies were clearly unethical," Mr. Alvarez said. The experiments continued until the early 1970s. There have been no follow-up studies since the prisoners were released.
- Eighteen patients with apparently dangerous illnesses were injected with high concentrations of plutonium at laboratories managed by Chicago and two other universities in experiments between 1945 to 1947. The injections were apparently made without the patients' informed consent. Similar experiments using injections of radioactive calcium were conducted on terminally ill cancer patients in New York. The purpose was to measure the rate at which radioactive substances are absorbed by human tissue. At the University of Rochester, six people with healthy kidneys were given uranium injections to conduct research on what caused kidney damage.

Greg Herken and James David, both researchers at the Smithsonian's National Air and Space Museum, have recounted the history of two doctors at the University of California Hospital at San Fransisco—Joseph G Hamilton, a neurologist and Robert S Stone, a radiologist. One of the aims of their human experiments was to use radioactivity as a weapon. As early as the spring of 1943, they discussed with the Army killing an unspecified number of enemy civilians by poisoning food or water with radioactive strontium. Dr. Hamilton started experimenting on a house painter believed to be suffering from terminal stomach cancer by injecting him with "many times the so-called lethal textbook dose" of plutonium. The patient was never told what he had been injected and the poor man dutifully collected his urine and faeces in glass bottles so that the good doctor could monitor the plutonium excretion from his body. A biopsy later showed that the patient suffered not from stomach cancer but from an ulcer! Dr. Hamilton, however, went on to inject plutonium into a boy with bone cancer and later into a black railroad worker also with bone cancer. Dr. Hamilton sent a secret note to the US Army in which he proposed using radioactive smoke as a killing agent. Such a type of preparation would appear well adapted for producing fission product aerosols to subject urban populations to fission product poisoning by inhalation. In October 1949, under his persuasion, the US Army conducted first of six experiments on radioactive aerosol idea in Utah.

Dr. Stone, the radiologist, was giving whole-body X-rays to arthritis patients and even the Atomic Energy Commission was alarmed by what he was doing. Herken and David say that the AEC experts wrote to him that they "do not wish to collaborate in clinical investigations with physicians in whose considered judgment they do not have any confidence." But Dr. Stone apparently continued his experiments, funded by the University of California, at an old-people's home in San Francisco.

Government scientists deliberately exploded atomic bombs in the atmosphere over the US in order to examine the spread and effects of radioactive fallout. The report identified 12 such tests, including one in 1950 in New Mexico after which radiation particle levels were carefully measured in the town of Walrous, 70 Miles away. At the time, scientists said

SPACE AGE RESEARCH

Astronauts in space encounter a great deal of cosmic radiation which can impair their motor ability. To test the effects of high radiation fields on muscular capability, mentally retarded children were made to draw pictures of simple objects like circles and triangles in a room, with a controllable caesium source.The radiation from the source was slowly raised till the children were unable to draw coherent shapes.

there was no risk to people, even though their purpose was to develop a weapon that would kill enemy soldiers through radioactive fallout.

In fact, according to the Los Alamos national laboratory, nerve centre of America's nuclear weapons research, there were about 250 experiments in which radiation was deliberately released into the atmosphere between 1944 and 1961, in New Mexico, Nevada, Utah, Washington state, and perhaps elsewhere,

"Releasing these amounts of radiation on people in an area in secret is a little hard to swallow," said Senator John Glenn, the former astronaut, who is pushing for the release of other government departments' records, including those of the Pentagon.

All of this has come on top of Ms O'Leary's announcement on December 8,1993 that the government conducted 204 previously undisclosed underground nuclear tests in the US between 1963 and 1990. Among this total are 18 unannounced tests undertaken during the Reagan and Bush administrations. Independent experts said they were at a loss to explain exactly what these later tests were for, or why they were kept secret.

Ms O'Leary said that between 600 and 800 people were subjected to government radiation experiments; she has set up a public telephone inquiry service called the Human Experimentation Hotline. On its first day in operation the hotline was swamped with calls from worried families.

The number of Americans intentionally exposed to radioactive atom test fallout, and its lasting after-effects is unknown. But a study of high fall-out downwind areas in Utah, for example, has found childhood leukaemia rates which are 2.5 times the national average.

Much of the macabre 'evidence' of human experimentation has been preserved. About 20,000 irradiated pieces of people are kept at a national human tissue depository in Spokane in Washington state.

Environmentalists and others say that Ms O'Leary and her staff—some of whom were formerly active opponents of the energy department and the nuclear establishment—have opened a Pandora' s Box.

The scale of the problem is staggering. A report by the federal environmental protection agency estimated recently that more than 43,300 military and industrial sites in the US are or may be contaminated by radioactivity.

Ms O'Leary says that by opening the files she hopes to set an example for other nuclear powers and to improve the department of energy's public image as it begins its domestic post Soviet nuclear clean-up. But most of all, she said recently, she wants the truth to come? out. When she learned of the human experiment* she was "appalled and shocked and it just gave me an ache in my gut and in my heart/' Ms O'Leary said.

Chilling too was the publication this week of a 1950 memorandum to senior atomic energy commission officials written by the very same Dr. Joseph Hamilton. It warnced that human experimentation was probably unethical, possibly illegal and perhaps a breach of the Nuremberg Code of 1947. If the information became public, Dr. Hamilton said, there would be a lot of criticism "as admittedly this would have a little of the Buchenwald touch."

Based on nports by Simon Tisdall in The Guardian (December 30, 1993) and Bharat Bhushan tn The Indian Express (January 30, 1994).

> *"Subjecting urban populations to radioactive aerosol poisoning by inhalation would appear to be a good killing agent. Human experimentation is probably unethical, possibly illegal and perhaps a breach of the Nuremberg Code* ***ofl94\. If the*** *information were to become public, there would be a lot of criticism as admittedly this would have a little of the Buchenwald touch."*
>
> ***Dr. Joseph G Hamilton***
> ***Neurologist, University of California (1960)***

WE ARE ALL GUINEA PIGS

The Department Of Energy's recent revelations about the testing of plutonium and other radioactive substances on uninformed people are at once chilling and liberating. Chilling because it is nearly impossible to believe that our own government could have acted so cynically and so contrary to any meaningful standard of ethical behavior. Liberating because exposing the truth is the first step toward correcting and redressing the reality

Energy Secretary Hazel O'Leary must be applauded not only for taking 40 years of cold war secrets and splashing them across the front pages of every newspaper in the U.S., but for directly attacking the good old boy network of the Clinton Administration and demanding compensation for radiation victims before the network could move to hush up the government's liability

It was a gutsy move, and we appreciate it. We understand that in Clinton's inner circles, O'Leary and EPA administrator Carol Browner are sometimes dismissively referred to as the "sob sisters." From where we sit—and we disagree with both often—they may be the only Clinton administration appointees with any backbone. Consider that O'Leary virtually single-handedly took on former Defense Secretary Les Aspin, the Joints Chief of Staff, and the rest of the military-industrial complex (yes, it still exists), and successfully fought for an end to nuclear weapons testing, on the simple grounds that the U.S. has no technical orscientific reason to conduct still more weapons tests. And to underscore the point, O'Leary released documentation proving that the U.S. had conducted at least one-third of its nuclear weapons tests in secret—as recently as 1990. It was a warning to the Pentagon and its supporters that there won't be any more secret weapons tests.

But O'Leary's welcome revelations that the government, and its all-too-willing partners in the medical community, conducted highly unethical radiation tests on civilian subjects only underscores a point that must not be overlooked: we are all guinea pigs.

Simply put, is there any ethical difference between deliberately exposing uninformed Americans to plutonium by injection or by deliberately releasing Iodine from Hanford or by exposing them to a myriad of elements through air anjl water from radioactive waste dumps? We think not.

The "medicaT'experiments, conducted with a "touch of Buchenwald" as they were deemed by one scientist, at least were limited. The experiment of "disposing" of radioactive waste in unlined trenches in the California desert, for example, could affect millions of Americans.

Enough scientific evidence has been accumulated to indicate that putting lethal radioactive reactor parts— and that's what "low-level" radioactive waste is —into the proposed Ward Valley dump is tantamount to signing a death warrant to Los Angeles, the most water-starved metropolitan area in the nation. The waste will leak, and it will enter the water supply. And all of southern California will become guinea pigs.

Exposing the truth is just the first step toward correcting am redressing the reality Even while reaching out to those who wen deliberately exposed t bizarre radiation experiments, we must recognise that we have all been exposed to unnecessary radiation from the nuclear experiment. We deserve closed reactors, not leaking waste dumps. We deserve a full re-evaluation of our policies, not a rehash of existing, inadequat laws. The nuclear industry cannot be allowed to generate more waste and radiation.

And so it goes for every other proposed "low—level" radioactive waste dump. In every case, there is a basic conflict between the hazardous lifetime of the waste (tens of thousands of years) and the institutional control periods established by law for the waste (100-500 years). And by the hazard posed by "low-level" reactor internals and the technology which doesn't yet exist to contain the radioactivity The reality and the laws don't mesh, and thus we have a grand experiment, one in which the American people will again be the losers.

A similar argument could, and must, be made for high-level waste, as it could for the routine operation of reactors, which must release radiation into the environment merely to operate.

The fact is, every few years the government and relevant scientific bodies must reduce their "acceptable" levels of radiation exposure as new evidence indicates there is no "safe" level of radiation exposure. And if there is no safe level of exposure, it is incumbent upon the government to eliminate public radiation exposure.

This the government will not do, and thus we are back into experimentation upon an uninformed and unconsenting public. As we learned from Nazi Germany, the Big Lie is always more effective than the small one. It is one thing to consider individual abuses; it is quite another to consider abuses on a mass level.

From Oak Ridge, to Han ford, to Three Mile Island, to Dresden, to Seabrook, to Ward Valley West Valley, and Yucca Mountain, experimentation upon uninformed and unconsenting people is wrong, and the nuclear era is nothing if not one grand experiment.

Even while reaching out to those who were deliberately exposed to bizarre radiation experiments at the height of the Cold War, we must recognise that we have all been exposed to unnecessary radiation from the nuclear experiment.

But how do we move from understanding the immorality of uninformed "medical" experimentation to halting the equally unethical but continuing nuclear age?

Yes, the waste and radioactivity must eventually be somewhere, and yes, the antinukes are willing to play a responsible role in ultimately devising a solution as acceptable as possible. But not under the existing, unethical, and failed laws and schemes, and not—as the debate is driven today-to merely allow the nuclear industry to generate more waste and radiation.

We work every day to make our elected officials, and the public as well, understand what the nuclear era really means, and why it needs to be dismantled as soon as possible. We try to help people understand the unique hazards posed by both the power and the longevity of radiation and radioactive waste. Maybe we don't work hard enough, that's certainly possible. But we also need your help. If the continued experimentation upon the American people distresses you as much as it does us, then contact your elected officials and demand an end to the nuclear age. We deserve closed reactors, not leaking waste dump*. We deserve a full re-evaluation of our policies, not a rehash of existing, inadequate laws.

And we deserve an ethical underpinning that says: no more nuclear experimentation on our citizens. We've had enough!

The nuclear era is nearly over. What we are seeing is the last twitch from the dinosaurs tail. Hut it* a large, powerful dinosaur that can be quite destructive unless tamed. We must all act, as directly and aggres. sively and joyously as possible, to ensure that the horrors so recently revealed are not simply prelude to far greater horrors to come. Our children will have other battles to fight; let this one be ours.

Michdel Mariottc, The Nuclear Monitor January 12, 1994

Deadly, even while dead

Count Dracula, it is said, rises from the dead to suck blood from the living. Shutdown nuclear plants can also rise from the dead and are far more dangerous.

According to US Nuclear Regulatory Commission (NRC), cold weather caused breaks in the service water system for Dresden-1 reactor in late January, resulting in a spill of some 55,000 gallons of contaminated water to the containment. The reactor has been shut down since October 1978. But according to an NRC report, it appears that only sheer luck averted a far greater catastrophe: an inspection found that the plant's irradiated fuel pool was vulnerable to the same type of weather-induced cracking. Within 40 minutes of such a crack, the fuel pool could have been uncovered. Consequences, says the NRC, would have been phenomenal dose rates at the pool of 2,700 rems an hour (a dose of 400 rems kills half the people who are unlucky enough to receive it immediately) and 19 rems/hour within 100 yards of the pool (which, the report dryly notes, is where the NRC resident inspector situ).

The Nuclear Monitor February 28, 1994

Guinea Pigs, Guinea Pigs Everywhere

It is natural for Americans to be shocked at the revelations that grievous harm and injury was deliberately caused to many ordinary American citizens by their own government. All of us tend to look upon 'our own' government as protector and guarantor of citizen's rights and to find instead that the protector himself is the violator, is a blow. The blow is greater because the government has been preaching 'concern for human rights and dignity' to all and sundry.

While I fully endorse the sentiments expressed in the "We are all guinea pigs" editorial of The Nuclear Monitor, and that is why we have republished it, there is something in the tone that I don't like. There is too much emphasis on "Americans". Experimentation without consent on uninformed beings is wrong whether they be Americans or Polynesians or Japanese, or any other racial or ethnic group. The US government during the war and later during the cold war did willfully cause radiation harm and injury to peaceful citizens of other countries as well as its own citizens.

The dropping of the A-bomb on Hiroshima and Nagasaki, was actually more in the nature of an 'experiment'. But there have been many other subsequent assays as well. The whole sorry saga of bomb testing has involved experimentation on a vast scale. This has been mainly done on populations in the Pacific and in the Nevada desert.

But American government is not alone in indulging in this criminal activity. All nuclear powers have been equally unmindful of human rights of weak and voiceless citizens. The Soviets in Kazhakhstan or in the Arctic, the French in Algeria and in the Pacific Islands, the British in Australia or the Chinese in Mongolia and in Tibet have not hesitated in sacrificing the health of innocent populations in the pursuit of nuclear 'power'. Even the one and only 'peaceful' nuclear power exploded its 'device' in the deserts of Rajasthan. There have been studies by doctors at the university of Jaipur showing increased incidence of cancers in the local population.

The revelations are shocking for another reason as well. They show the widespread involvement of 'respected' researches in prestigious universities and research institutions. Even those who are not dismayed by the dark deeds of governments, are apt to be aghast at this involvement, since it goes against much cherished notions about scientific humanism and integrity

The widespread involvement of scientists at many different universities, makes it all the more astonishing that it took more than 40 years for the facts to come out in a society which prides itself on being free and where the press is known to be so active and outspoken. This conspiracy of silence has involved many, perhaps thousands. The 'experiments' could not have been conducted without the willing cooperation of research assistants and lab technicians and office administrators and the whole paraphernalia that constitutes 'modern' research. That none of these tried (or succeeded if they tried) to penetrate the dark veil of secrecy, is a telling illustration of enormous dead weight the System' has. All of us, you and I, are afraid of making a 'scene' and it is this apathy which allows the grossest crimes.

It is in this context, that these revelations of American misdeeds are of importance to us in India today. For one thing, Indian nucleocrats have learnt not only nuclear technology in American nuclear establishments but they have also imbibed the prevailing 'culture'. The practice of hiring large numbers of poor, untrained 'casual' workers at nuclear power plants so that the individual doses of the regular staff are reduced, is an old American custom which has been fervently followed in Indian nuclear establishments. No monitoring of the health of these workers is being done. This is worse than experimentation, since although the authorities are damaging the health of these poor people, they do not bother to even record the 'experiment'. The conspiracy of silence is no less deafening in India. Reports regarding deformities and ill-health at Rawatbhata and Jaduguda have come many times in the press and yet the victims have still not received government attention.

"Internationally accepted norms" form a powerful shield to cover wrongdoing everywhere. This magic mantra is invoked by Indian nucleocrats as the last word to stifle any protest. (For example, see the article "AERB Chief admits nuclear workers exposed to high radiation levels" in this issue.) Although individual exposures in India may (and it is a big may), be within internationally accepted limits, these limits themselves are certainly not safe and have been revised downwards frequently in the past. It is also ironical that a number of experts in the field of radiation have obtained their expertise through precisely such ethically dubious experimentation. It is the opinions or such 'experts' which has been accepted by the judges in a large number of radiation injury cases.

We are all guinea pigs but even guinea pigs should have rights and it is only when we are ready to stand up for guinea pigs that we have a moral claim to stand up for our rights.

Surendra Gadekar

Nuclear Inspector Sues Industry

Says Leukaemia Caused By Radiation At Work

A former US Nuclear Regulatory Commission resident inspector at Southern California Edison's San Onofre nuclear complex is suing the utility, its partner—San Diego Gas & Electric, Westinghouse, Combustion Engineering and Bechtel Corporation on the grounds that her work at the plant resulted in radiation exposures that caused her to contract acute myelogenous leukaemia.

44-year old Ruth Tang, who has been told by her doctors that she has about six months to live, is at the center of a lawsuit that could shake the nuclear power industry to its foundations.

Tang alleges that her cancer was caused by radiation exposure from her work at San Onofre. Especially during 1985-87, the plant was plagued by defective fuel rods and radioactive "fleas," highly radioactive but microscopic particles which cling to workers' clothes and skin. Her suit charges that standard dosimeters used in the nuclear industry do not accurately measure such exposures, and thus there is no way of knowing how much radiation she actually received while working at the plant.

And the suit brings up even larger issues. For example, if radioactive "fleas" cannot be detected by the industry, then how many have been set loose in communities across the nation and the world? And the suit also challenges the notion that there is any safe radiation dose.

Said Tang's attorney, Don Howarth, "If we're successful, we will crack open for the first time the liability of these nuclear power plants for what they"ve been doing to their workers and the communities outside."

The utilities attempted to have the case dismissed before trial, but a federal judge ruled that the case involves complex matters of fedoral and state law, and would be heard. The trial began in early January.

Tang is supported by Dr. Edward Radford of the University of Pittsburgh, Dr. Harry Demopoulos of New York University, and by F. Morgan Cox, a health physicist. All argue that industry dosimeters are inaccurate. In an affidavit, for example, Cox said, "these devices register external dose only and do not take into account any internal radiation dose. Second, these dosimeters do not detect or record alpha radiation, except in rare instances of actual contact with the radiation source. Third, they will detect and record beta radiation to a limited extent, and only if such radiation is in close proximity to the dosimeter **and is** not shielded. In addition, TLD's do not detect or record low energy gamma radiation or gamma radiation from sources too far from the device."

Mistrial Declared

A mistrial was declared February 9 in the case of Ruth Tang. According to CNN, the jury was deadlocked at 7-2 in tang's favour. A retrial has been set to begin March 1, 1994 although CNN reported that Southern California Edison and the other defendants in the case might now offer Tang an out of court settlement.

According to Tang's dosimeters, she received a total of 34 millirems during the period June 1985 to December 1986. But contradictory readings, and internal utility documents which revealed both the presence of the radioactive "fleas," and utility concern over the inadequacy of the dosimeters, persuaded the scientists that her actual dose may have been far higher.

And if her dose were higher, there is little reason to believe other workers' doses were not higher as well. Further, because the "fleas" cannot be easily detected, they tnay have spread throughout local communities on workers' clothes and skin.

The utilities also argued that they should not have to face liability because their releases were within regulatory limits and because the Price Anderson Act limits their liability But the court rejected both arguments. Normally, civil suits such as this take years to resolve. But Federal Judge Gordon Thompson Jr. accelerated the trial when he learned of Tang's limited life expectancy.

Tang, who has a master's degree in nuclear engineering from MIT, told the Los *Angeles Times* that she is filing suit to provide money for her daughter, who is also studying at MIT. Originally, her daughter wanted to study nuclear engineering, but Tang talked her out of it. "I didn't want to do it," Tang told the *Times,* but I didn't think it was safe."

The Nuclear Monitor
January 17 and February 14,$_f$ 1994

The Answer, My Friend, is Blowing in the Wind

Portland General Electric (PGE), which closed its Trojan reactor early last year, has decided that wind power will play a major role in its future. The utility announced December 28, 1993 that it has selected a bid for a 100 M W wind plant, which is scheduled to be operational by 1996. PGE also selected 21.1 MW of geothermal energy proposals, 32 MWofbiomass,and 16 MWof hydro. According to a PGE spokesman, the utility intends to quadruple its wind commitment by 2002, and could quadruple it again by 2012.

The answer also lies in White Paint

Ask energy—efficiency expert Art Rosenfield what Los Angeles needs to keep cool in those long hot summers and he'd most likely say a can of white paint.

In a recent study he conducted at the Centre for Buidling Sciences at Lawrence Berkeley Laboratory in California, he and his researchers whitewashed the roof of a house in Sacramento and found the house used 40 percent less cooling energy in summer. If this is were applied to the whole of the United States, which uses 10 percent of its electricity on summer air conditioning, the potential energy savings would be enormous.

Art says he was inspired by Mediterranean countries where not only roofs, but walls and roads are whitewashed. Indeed, in Israel, urban residents are required by law to annually paint their roofs white.

He believes whitewashing would significantly curb the solar radiation absorbed by dark rooftops and asphalt in cities like Los Angeles. Raising that city's albedo (the percentage of solar radiation reflected rather than absorbed) from 0.15 to 0.25, would reduce the "heat is land" effect and lower the city's summer temperature by 5-8 degrees Fahrenheit, and save about two giga watts of energy during peak air conditioning use. In financial terms, this would save the Angelenos a cool $700 million a year.

And also in hog shit at the farm

After American pig farmer Roy Sharp built a lagoon to treat the wastes from his 16,000 hogs and covered it with a tent to control odours, he wondered if he could burn the trapped methane gases to produce electricity. Engineers told him it would never be cost-effective, because such a system couldn't produce more than 26 kilowatts(kW) of electricity an hour. Roy went ahead and built his lagoon anyway. "We're now getting 140kW ar\ hour during the summer," he says. "What we're doing here is confounding the experts." The pig gas power plant produces enough energy to cover the farm's monthly $3900 electricity bill. Meanwhile, Roy receives $400-900 a month from the local power company for the excess electricity he's pumping into the local grid. And the lagoon system is now been considered by Russia, China and eastern Europe.

But the answer certainly does not lie in accepting Dutch Bull-Shit

India, the land of phoren goods, from mineral water, aerated drinks, chewing gum, Kentukky Fried Chicken, ... is about to become the world repository of cowdungand hog droppings. Dutch farmers along with other European farmers have been stuffing their farm animals with all kinds of chemicals and drugs. Thus, the dung is full of these poisons and poses a serious danger to people. Chemials from cattledung are one of the major cause of groundwater pollution in Holland. European environmental regulations do not allow the dumping into the seas. Till now the 'solution' had been to dump these wastes in Africa, but now environmental protest there has persuaded the Dutch government to view Manmohan Singh's new India with 'favour.'

Seaswan B.V., a company based in Wassenaar and EID Parry of Madras have formed a joint venture. The project envisages importing seven to ten million tons of dung eveiy year. Prior to traasportation to India, biogas will be extracted from'the manure. Then it would be loaded into large tankers and set sail for Kandla. After drying in various locations in Gujarat, the material would be sold as 'Envirodung' in Indian markets. The investment in India to import this shit is estimated to be US $150 million. It will create 150 jobs for the natives.

The project document states, "India has a fertiliser market of 26 million tons a year. India is in the process of decontrolling its feriliser prices. As a consequence, older and inefficient fertiliser units will shut down. The market will for sometime stabilise at a lower volume and with higher prices. This situation opens up a strategic advantage for the Indian Environdung joint venture." Holy Cow!

Based on reports in The Nuclear Monitor (US), Third Opinion (Australia) and an Action Alert issued by Public Interest Research Group Delhi.

The Foreign Connection

> *"The truth is, more people are making a living by talking about radiation induced diseases than dying of them. It has become fashionable to talk of radiation as the inducer of cancer and genetic abnormalities although research and studies conducted worldwide have proved otherwise."*
>
> A *N. Prasad*
> *Director,*
> *Bhabha Atomic Research Centre*

hW ad has said funny if the truth were not so sad. Anybody who is a victim of an environmental polluting agent has a horrid existence. First, there is the suffering induced by the disease itself. On top of that you have to constantly fight an uncaring system which tries to blame the victim for the disability.

However, there is one point on which I agree with Dr. Prasad. I dearly wish the situation he describes actually becomes reality. It is only when many more people than just those 'affected' would talk about radiation induced diseases and take up the struggle, that we would be able to put an end to this madness.

Dr. Prasad is the head of the only institution allowed to do research on nuclear energy in the country and I cannot believe he could be as ignorant as his words imply. If he were just to read the first page of any standard textbook on radiation biology, he would know that radiation has been well established as a causative agent in many different types of cancers in both human and animal studies conducted in all parts of the world since many decades.

The BARC chief made this assertion while denouncing a TV programme on CBS network. On Sunday, February 13, 1994, a programme entitled '60 minutes" had carried a feature on the Indian nuclear programme. Since I have not seen the show, I cannot comment on the contents. However, I wonder if the heads of atomic research centres like the one at Harwell in England or Argonne near Chicago in the US ever feel constrained to make comments about a TV programme broadcast on the Doordarshan? The guys at BARC obviously do, though not about programmes on Doordarshan (their pocket network) but on •phoren' TV networks and whenever they do open their mouths they invariably remind one how appropriate is the acronym of their institution.

The following is the report which *The Times of India* had carried on the feature.

Indian N-plants most unsafe, says CBS

Washington, Fcbmaty 14.

CBS 60 minutes, which has a very large nation-wide audience, today charged that India is operating the most unsafe nuclear plants in the world without inspection by the International Atomic Energy Agency (IAEA), reports PTI.

The programme dovetails with the U.S. government policy of demanding fulls cope safeguards in India and depriving the Indian armed forces, if they can, of any modern missile technology on the pretext that what India does is destabilising vis-a-vis Pakistan.

The programme is expected to he used both by officials and members of Congress to put further pressure on India.

The programme did earry an inteiview with an Indian official but in a context that cast doubt on the truth of what he was saying about India's ability to run nuclear plants without the IAEA holding its hand.

The programme also charged that no care is taken for the safety of either the workers or the people near the plants with the result that workers are .severely injured (pictures of burn marks were shown).

With confirmation by an American-trained Indian doctor, CBS TV also said that due largely to the radioactive contamination, children are born in areas nearby without ears, with two thumbs and so on.

An English analyst, Mr. Steven Thomas, who said that he had been closely tracking the Indian nuclear programme for 15 years, said that India's nuclear plants had far more emergency shutdowns than in any country in the world and that this was a sure sign of trouble Things were going wrong all the time, he said.

Almost as an afterthought, the network said the rest of the world is denying India not only nuclear equipment and fuel but also safety equipment in order to curb India's programme (unless it agrees to the M.S. demand for fullscope safeguards.)

The network also said that the U.S. nuclear regulatory commission said in a report that the fire in the reactor at Narora "was a close call. Just how close may never be known "

The network did not explain why western governments, if they are so concerned about the safety of India's nuclear plants, are banning the export of nuclear safety systems for India.

But it complained that while attention is being paid to unsafe reactors in Russia and to the nuclear programmes of countries like Iran, "one country that has largely escaped scrutiny is India where nothing seems as important as its membership in the nuclear club. Over the years it has steadfastly kept international safety inspectors out of its facilities while pursuing one of the most dangerous and essentially secret nuclear programmes in the world."

Just last year, said the network, there had been 136 nuclear incidents and five of them ended up killing people. It noted a Bombay newspaper as calling the U.S.-built and internationally inspected Tarapur power plant one of the most contaminated power stations of its kind in the world.

"Vilification Campaign"

The BARC chief denounced this programme as "a vilification campaign aimed at discrediting the country's nuclear energy programme and raising doubts about its technological capability."Commenting on the charge that India proposed to become a member of the nuclear club, Prasad said "this is a dead give-away of the real intentions of such a vilification campaign." Prasad "urged all members of the scientific community to counter such propaganda in the interests of the country."

I am struck by two related questions. First, why are these foreigners suddenly so interested in our nuclear programme. The problems that beset the Indian nuclear muddle are of long standing. The fact that "things are going wrong all the time" has been known for ages. We at *Anumukti* have been saying the same thing for the last seven years without fail six times a year. Then why is it that all of a sudden US TV programmes with a viewer ship of millions have suddenly found this newsworthy?

The other question is what I posed at the beginning of the article regarding the protest by senior Indian nucleocrats. Don't they have anything better to do then 'answering' all and sundry charges leveled in TV shows? I am inclined to believe that may be the nuclear programme is not in such dire straits after all, seeing the amount of time these high officials have for the press media.

Recently, Dr. M. R. Srinivasan, the ex-chairman of the Department of Atomic Energy, wrote a series of three articles on nuclear power. The following is an extract from the third article in the series which was published in *The Hindu* on 13th January, 1994.

Dismal State of Nuclear Finances

"We are at present producing only about two per cent of our electricity from nuclear sources. If we had implemented the programme of 10,000 MW of nuclear power by 2000 AD, some 10 to 15 per cent of the electricity would have come from nuclear energy., After 1990, funding of the nuclear power programme has dropped drastically and the target has slipped to some 3,000 to 4,000 MW by 2000 AD.

"An important component of the long term plan was induction of 500 MW reactors of heavy water type, based on indigenous technology. Unfortunately, no funds have been made available for starting construction, although the design work has been completed. In the new economic environment prevailing, the Government is allergic to funding power projects and would like the capital market to be tapped. This may be in order for thermal power plants burning coal, oil, or gas but will not help in the growth of nuclear power.

France to the Rescue?

"France which has an enviable nuclear power programme has built it up largely through public funding and bonds issued by the Electricite du France. In addition to pursuing the heavy water reactor line based on indigenous technology the country should explore the possibility of building some light water reactors also, as the 1,000 MW PWR has become the equivalent of Boeing 747. In 1988, India and the former Soviet Union agreed to cooperate on building two 1000 MW plants at a site in the southern tip of India. However, with the collapse of the Soviet Union, this project is a nonstarter.

"At that time, the French industry, in cooperation with Germany, was keen to build in India some PWRs. France had then not signed the NPT and India could have got these reactors without acceding to the NPT or accepting full scope safeguards. The situation has changed after France joined the NPT in 1992. However, India may still explore a way out if a joint French Gorman—Indian ownership of the reactors were feasible, through a tripartite investment.

"Since the nuclear industries of France and Germany are starved of orders, they may welcome such an option. India may be able to have some PWRs, without having to sign NPT or accepting fullscope safeguards. Enriched uranium for these stations will have to come from France. In this way, the country will be able to speed up nuclear power development, without giving up India's reactor line based on heavy water and natural uranium, or the basic position on NPT or safeguards.

"What the country needs is a continuing political commitment to nuclear power. For its part the scientific and technical community must take on an activist posture to convince the public of the relevance of nuclear power and seek its full support. If these initiatives are not taken, the country will miss the benefits that nuclear technology promised. The dedicated work done by the large band of pioneers in mastering a difficult technology will then have been in vain."

I have quoted Dr. Srinivasan at length, because I think he does shed valuable light on the questions I had raised earlier The Indian nuclear programme, this monstrous undertaking involving an outlay of billions and the lives of many, is actually just a pawn in the game of power politics. Foreign networks have suddenly become interested for two reasons. Firstly because it is time to renew signatures on the NPT and this time the big boys do not want bit players like India to get away without signing on the dotted line. After getting that signature these commercial interests would be extremely keen to sell India their technology and [4]knowhow\ Like what has happened in Eastern Europe and the former Soviet Union, they are not interested in a safer, cleaner non-nuclear world but only in selling their much touted 'safe' nuclear technology. The Indian nuclear establishment is equally keen to establish links with foreign nuclear industry. The belligerent "determination to forge ahead in frontline areas of science and technology is all a sham. If these links can be forged without having to sign on NPT, so much the better. But if worst comes to worst, and they have to find a fig leaf to cover themselves, well 'libralisation'and globalisation are the key words today and a high sounding justification would be found. Western nuclear industry, starved of orders at home *(how come? Drs. Sritivasan and Prasad, if nuclear energy is such a panacea?)* would pressure Western governments to look the other way as they have been doing till now. It is a question of who blinks first on NPT but on the wider issue of nuclear power Indian and Western governments and the nuclear industry are on the same side and against the better interests of the people.

I am also amused at the call to the scientific community to take up pronuke activism made by both Dr. Srinivasan and by Dr. Prasad. The wollspring of activism is deep conviction born out of truth and compassion. A system which breeds lies and deception and an arrogant contempt for people as nuclear power does, cannot give rise to activism. It is not the vocation of people out to "make a living".

Surendra Gadehar

AERB Admits Nuclear Workers Exposed to High Radiation Levels

The Atomic Energy Regulatory Board (AERB) admits workers in Indian nuclear plants are exposed to "very high" levels of radiation, but opposes workers* demands for financial compensation on the ground this would lead to "undesirable practices and laxity in providing the necessary protection."

According to AERB Chairman Dr. Gopalakrishnan, radiation workers' demands for compensation in the form of radiation leave or radiation work allowance are inappropriate and unjustifiable. While the board is aware that the collective dose to workers in Indian nuclear plants is very high—individual doses appear to be kept within "acceptable levels".

Dr. Gopalakrishnan told a recent meeting here of the Indian Association for Radiation Protection that reducing the individual doses alone without bringing down the overall man-rem consumption is not an acceptable strategy, and said the AERB has directed management's to give top priority to reduction of the collective dose.

Qualified persons from outside the Department of Atomic Energy should be inducted on to various committees which are looking into the causes of overexposure and the decisions of the committees should be conveyed to the workers in writing Dr. Gopalakrishnan said. The public at large would feel more comfortable if evaluation of radiation doses received by workers in Department of Atomic Energy (DAE) installations were done by an outside agency rather than by scientists at BARC. The AERB would lay down standards and monitor the independent non-Governmental agency which could initially be given the task of evaluating workers' TLD badges.

"Under a new set of guidelines issued by the AERB in January, India has become one of the few nations to fully meet the dose limit for radiation workers stipulated by the International Commission on Radiological Protection(ICRP)." It was imperative to impose a cumulative dose limit of 100 mSv over a five-year block starting with January, while keeping in place the currently stipulated upper limit of 30 mSv for annual exposure, Dr. Gopalakrishnan said. "These limits are well within the ICRP recommendations."

Employers would have to seriously analyse the activities of overexposed workers. Dr. Gopalakrishnan said, emphasising the need for increased automation and robotics, proper radiation shielding, decontamination of areas and equipment and consistently good housekeeping.

*News report in The Pioneer 3.2.*94.

Nuclear Power Corporation Brings Out the Begging Bowl

The first estimate of financial damage to the Nuclear Power Corporation due to the devastating fire last year at the Narora nuclear plant's reactor unit-1 had spoken of a figure in the neighbourhood of Rs 150 crores. Later revised reports had put the figure more conservatively at Rs 40 crores. Dr Chidambaram, the chairman of the Department of Atomic Energy had claimed then that the crippled reactor would be back in operation in just four months. "The fire will cause an extra delay of just two months in the resumption of operation of the unit, since anyway it was scheduled for a two months annual shutdown for maintenance purposes." The unit has still nrt resumed production although nearly an year has passed. An year's interest on the huge investment, has already made the first 'hurried' guess of the monetory loss closer to the truth.

Run For Cover

An interesting aspect of nuclear power plant safety in India is that the NPC and the government-owned General Insurance Corp. (GIC) have not been able to come to any agreement regarding insurance of the plants. The insurance company, though government-owned, usually takes a reinsurance cover from one of the London "clubs" and is not willing to cover the entire risk of an accident by itself The NPC is not willing to involve "any foreigner" in examining its plants in case there is an accident and claims have to be settled. GIC is not able to guarantee complete secrecy of the plant operations and so far has not insured the nuclear power plants.

Nucleonics Week June 17, 1993

Following the fire, the Atomic Energy Regulatory Board (AERB) directed the Nuclear Power Corporation (NPC) to shut down its plants one after another for inspection. The inspection was intended to avoid a repeat of the Narora incident. Thereafter, it was proposed that during the 6-8 week annual shutdown of the plants, modified turbine blading would be installed in these plants. This step has been necessiated due to the fact that the turbine blades which were manufactured by BHEL have shown a tendency to shear. The original design of the blades was supplied by GE and there have been a large number of instances of similar problems reported in GE blades as well in the past.

The shutdowns are only one of the multitude of problems that plague NPC. As a result, even the reduced target of 5,000 MW of installed capacity by the end of the century seems too ambitious, and the likely achievable target is only 2820 MW. This is because of a major resource crunch in the face of the government's progressively decreasing budgetary support. The government's contribution has come down from 63 per cent of the approved outlay in 1988-89 to **a** low of 15 per cent year before **last** and just 17 per cent last year. I do not know the figure for the current year.

Meanwhile, the corporation's market borrowings have been rising steadily and now stand **at** Rs. 1,884 crores. This translates to an annual interest burden of Rs. 257 crores payable from 1995 onwards. Further, the corporation owes about Rs. 800 crores to the department of atomic energy (DAE) as fuel and heavy water charges and this amount is reported to be increasing at the rate of Rs. 400 crores per year.

A proposal for converting NPC's **dues** to DAE into equity is pending before the government, says Mr. C.K, Koshy, the corporation's executive director for personnel and finance. However, the move can be justified only if a definite turn-around is fenvisaged in NPC's fortunes, since it amounts to increasing the government's stake in the corporation.

NPC needs about Rs. 4,000 crores to complete its ongoing projects over the next seven years. Opinion is divided over continuing with advance procurement for projects which are yet to take any tangible shape. It is felt that all the resources should be directed towards completing the ongoing projects on schedule. This will considerably improve the funds situation as about 35 per cent of the available funds are currently used for advance procurement.

However, Mr. Koshy says that since the raising of funds is an annual exercise, the corporation's target should be revised in the context of the availability of funds. He adds that advance procurement has already been reduced in the same proportion as the scaling down of the corporation's target, except in cases where contractual agreements existed.

In their defence, NPC officials say that the government has backed out of its earlier commitment of meeting half the project cost as well as the interest burden while NPC was expected to raise the rest. They also say that the earlier target of 10,000 MW of installed capacity by the year 2000 was something that the government had projected on non-economic assumptions, and that they themselves would not have taken a decision to increase capacity tenfold. It may be recalled that installed capacity was 840 MW in 1984 when the decision was taken to increase it to 10,000 MW.

If NPC's finances are in trouble, so are various aspects of its operations and management, To begin with the corporation's average capacity utilisation for 1992 was a poor 53 per cent while the availability factor was only slightly higher at 64 per cent. The corporation's project completion in some cases has taken as much as 12 years in comparisen to seven years in developed countries. Also worrisome is the fact that over the past years NPC's profits have shown no increase despite separate accounting for projects and generation. In addition, the employee strength has gone up from 1,300 six years ago to 2,300 today. NPC employees' association put the blame for the poor financial state on mismanagement by officials.

On its part NPC has been investigating alternate means of finance. Some state governments are reported to have shown an interest for their respective electricity boards entering into equity participation with NPC, However, certain quarters within NPC are hesitant to enter into any such alliance since NPC is still to recover Rs. 480 crores (including penal interest) from various state electricity boards to which it has supplied power.

But there does seem to be one thing over which most people in NPC are agreed. They agree that a macro-level decision questioning the very relevance of nuclear power in the Indian context needs to be taken. And if the verdict is to continue with it, then it must be backed up with sufficient funds.

Based on newsreports in Times of India, Jansatta and Indian Express

Uranium Tipped Ammunition

During the uranium enrichment process required to make nuclear weapons or fuel for reactors, the concentration of the 'fissile' U-235 isotope has to be increased. What is left, is called depleted uranium (DU). It is about half as radioactive as natural uranium, but very dense and extremely hard. In a powdery form it burns easily and is hence a very good material for armour piercing shells. Because it is a waste product of the nuclear industry, it is probably supplied free to weapons' manufacturers.

A 1979 British defence ministry memorandum states that tungsten alloys were then in *use* but: "The effectiveness of armour-piercing tank gun ammunition depends largely on the density of the metal from which it is made. DU has proved the most effective anti-armour penetrator and is also consideraably cheaper than tungsten.

External radiation levels from depleted uranium are low. Standing near a DU contaminated vehicle shouldn't be any more harmful than background radiation, as far as external radiation is concerned. However, DU is about as toxic as lead and could be harmful to the kidneys if eaten or inhaled. When DU burns in a fire, it converts into a form which can be readily absorbed by the body. If ingested or inhaled, the toxic effects of DU dust could damage the kidneys, and the short range alpha radiation emitted would increase the risk of contracting cancer

Reasons for Concern

British Atomic Energy Authority estimates that the tens of thousands of rounds of penetrator DU bullets fired during the war left behind 41 tonnes of radioactive debris scat* tered over Kuwait and Iraq.

Just loading a DU bullet exposes tank crews to the equivalent of one chest x-ray every 20-30 hours. British troops have complained of memory loss, fatigue, skin disorders, headaches, eye and ear infections, bleeding gums, hair and weight loss, facial paralysis, damaged lungs and general collapse of the immune ays-

Protesters Beware!

Incongruously, the nuclear industry is promoting a non-lethal weapon. Sandia National Laboratories— a nuclear weapon's establishment in New Mexico specialising in nuclear safeguards— designed a sticky foam which could flood nuclear stores, preventing theft by terrorist or freelance bomb maker.

Now, with an idea stolen from 2000 AD's comic-book star Judge Dredd, the company is developing a method of firing the foam at people for use in riot control. There is still one major problem to overcome, a familiar one for the nuclear industry, how to clean up the mess afterwards.

Perhaps they could just entomb the sticky rioters in concrete for 100 years while they figure out how to decommission them.

Safe Energy February / March 1994

tern. According to the UK Atomic Energy Authority, there is' enough DU in Kuwait and southern Iraq to cause 500,000 potential deaths. But documents released under the US Freedom of Information Act indicate there could be as much as 300 tonnes of DU out there — with a potential death toll of 3.75 million!

The US Defense Department admitted in a memorandum in May '91 that the use of depleted uranium "results in remnants that are subject to atmospheric oxidation and/or aqueous corrosion. Either process can 4ead to environmental contamination that has the potential to cause adverse impacts on human health, primarily through the water pathway ...
"Surface oxidation of fragments of depleted uranium penetrators is a significant process because oxidised forms of uranium are more soluble in water, and thus potentially more available for ingestion by humans and animals."

Although the US has spent a lot of money recovering contaminated US military vehicles from the battlefield and returning them home for disposal as nuclear waste, nothing has been done in Iraq and little in Kuwait to recover these remaining DU rounds. Cleanup workers in Kuwait have been unprepared to deal with the hundreds of contaminated Iraqi vehicles.

The province of Saskatchewan in Canada is investigating whether Canadian uranium was illegally diverted to make depleted uranium penetrator bullets, which were subsequently used by US during the Gulf War.

Moreover, Iraqi and Kuwaiti children have been found playing with the bullets. Saskatchewan's Inter-Church Uranium Committee, which claims at least a 450,000 kilos of Canadian uranium were covertly turned into DU bullets for the US military, is alarmed at the rising incidence of cancer and leukaemia among Kuwaiti children.

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A J urnol Devoted to Non-Nuclear India

Volume 7 Number 5 April / May 1994

The B and palnt of Mice and Men

Consider the following:

"Radioactive material transport has maintained an excellent record of safety in India. This is primarily due to strict enforcement of national regulations. The regulations emphasize on the bulit-in safety of packages rather than operational controls in order to ensure that the transport workers and members of the public are adequately protected against radiation hazards in normal as well as accidental conditions of transport. The packaging containing radioactive materia shall be designed to withstand the rigours of transport

"The number of radioactive material packages transported in India increased from about 12,600 packages in 1961 to over 24,000 in 1992. It is estimated that more than 10 million packages are transported each year throughout the world

'In India, the Chairman, Atomic Energy Regulatory Board (AERB), is the competent authority for enforcing regulations relating to radiation safety including transport Transport of radioactive materials is governed by the surveillance procedures issued under the Radiation Protection Rules, 1971 and the safety code, AERBATR-1, 1986 issued by AERB. The safety code is based on the international standard of International Atomic Energy Agency (IAEA). The IAEA regulations are incorporated in regulations of various international organisations such as International Air Transport Association (IATA), International Civil Aviation Organisation (ICAO), International Maritime Organisation (EMO), Universal Postal Union (UPU) etc. and national regulations of member states."

I am quoting all this from an unimpeachable source—Newsletter of the Atomic Energy Regulatory Board. Now consider this:

"During month of October, 1993 a radiography agency collected a 1.6 TBq (43Cis) Ir-192 source in a Techops-660 camera. The above camera was packed in a steel trunk along with accessories and was taken to railway station to be taken to a radiography site. The above parcel was booked in a brake-van without any mention of the nature of the contents or declaring its correct value. Alter handing over the trunk containing lechops-camera to parcel clerk the radiographer did not check whether the above parcel was booked in a particular train. He did not travel by the train in which the parcel was supposed to have been loaded. Immediately upon arriving he did not check whether the parcel containing the radioactive material has reached or not. Next day morning when he went to collect the above parcel he was told by railway official* that it is missing. The loss of the radiography camera along with source could have been avoided if the accepted secure mode of transport had been used. The radiographer leaving the parcel in the booking office was away from the station for a longtime.

"Radiation Protection Services Division was not informed immediately by the party of the missing camera containing source. Nearly ten days later a search using radiation detection equipment was carried out but with no success. Scrap dealers shops have also been checked for missing source.*

Action en

"The radiography agency was asked to suspend the radiography operations and return all radiography sources immediately."

The above is taken from another unimpeachable souce: An information notice issued by the Radiation Protection Services Division of the Bhabha Atomic Research Centre and sent to all users of industrial gamma radiography sources.

Remember Galania

Around the end of 1985, a private radiotherapy institute, the Institute Goiano de Radioterapia in Goiania, Brazil, moved to new premises, taking with it a cobalt-60 teletherapy unit and leaving in place a caesium-137 teletherapy unit without notifying the licensing authority as required under the terms of the institutes license. The former premises were subsequently partly demolished. On 13 September 1987, two people entered the premises and thinking that the unit might have some scrap value, removed the source assembly which they took home and tried to dismantle. In the attempt the source capsule was ruptured. The remnants of the source assembly were sold for scrap to a junkyard owner. He noticed that the source material glowed blue in the dark. Several persons were fascinated by this and over a period of days friends and relatives came and saw the phenomenon. Fragments of the source the size of rice grains were distributed to several families. This proceeded for five days, by which time a number of people were showing gastrointestinal symptoms arising from their exposure to radiation from the source.

The symptoms were not initially recognised as being due to irradiation. However, one of the persons irradiated connected the illnesses with the source capsule and took the remnants to the public health department in the city. This action began a chain of events which led to the discovery of the accident, which was one of the most serious radiological accidents ever to have occurred. In all over 112,000 persons were monitored, of whom 249 were found to be contaminated either internally or externally, 20 persons required hospitalization and four people died of acute radiation syndrome within four weeks of the accident. (The Bulletin of the International Atomic Energy Agency)

So, here we have this 43 Curies Iridium-192 source which is lost'. The 'action taken[1] in this case is a typical instance of the way corporate polluters are 'punished'. Even the name of the radiography unit involved in this grossly irresponsible act has not been mentioned lest it give offense. Is that a way these companies using horridly dangerous substances can be made to mend their ways? Iridium-192 gives out strong gamma rays which require a shielding of one to six centimetres of steel. It also gives out beta rays which can cause skin burns. Iridium-192 has a half-life of 74 days which means that it would be two to four years before its radioactivity decays to about one millionth of its present value. 43 Curies is a huge amount of radioactivity. For comparison sake, the radioactive sources which had been dumped in the river Cooum in Madras last September (See Much a Dooum on the Cooum in Anumukti Vol. 7 No. 2 October/November 93) according to the publication Nuclear India of the Department of Atomic Energy were 1.5 Curies—caesium, 18 and 0.5 Curies—Americium-Beryllium neutron sources respectively To recover these sources, the Atomic Energy Regulatory Board showed exemplary alertness and these were recovered after a month of intensive effort and the expenditure of about 40 lakhs of rupees. What does Dr. Gopalakrishnan, the AERB supremo propose to do to mitigate this new menace and recover this radioactive camera, or does he find the slush and stink of the Cooum more congenial than the chaos that is Indian Railways?

From The Editor's 'Desk

There was a time when Gujarat was the land of Gandhi, Jinnah and Sardar—a land that taught the world that courtsey and good manners in dealing with one's opponents were not a sign of weakness but of strength. One could be totally uncompromising in one's adherance to a principled stand, be the Iron Man of India and yet combine this mule-like stubbornness with grace and magnanimity that would charm one's most intractable opponents. Alas, those days are history. Today's Gujarat is not the land of the old Sardar but of the new, self-styled one. Anti-social boors rule the roost using muscle and money power with active connivance of state machinary.

The incident at Barod vhere thugs masquerading as political activists vandalised the office of mada Bachao Andolan is an outrage even in these devalued times.' fact that some sections of the Gujarati press, hailed the attack only derscores the total moral bankruptcy that engulfs even so called 'ectuals. However, the forthright condemnation of the attack by so the staunchest supporters of the dam is a silver lining. It is high the innate good sense amongst the ordinary people of Gu, lf and a halt is cried to this goose-step march in Hitler's footsteps.

Old Reactors Never Die Neither Do They Just Fade Away.

It is High Time Tarapur Was Decommissioned

Nucleocrata who decided to commission the two Boiling Water Reactors (BWR) at Tarapur on 1st April 1969, knew what they were doing. They were playing a huge practical joke on the nation in keeping with the traditions long associated with the date.

The decision to Ibuild a nuclear power station in the Western region was taken in 1968. TVirapur, 100km north of Bombay was chosen as a site in August I960. Preliminary agreements uild TAPS were signed in August 1963. Each unit was to be similar to the Dresden-1 reactor which had been built by GE and completed in 1960. A loan of 80 million dollars was made by USAID toward the reactor cost and the fabrication of the initial fuel charge. This came at an interest rate of 3/4% and repayment was to be over a thirty year period beginning June 1976. Construction began in October 1964 and GE gave a firm completion date of October 1968 as well as guarantees about the output and the efficiency of the station. But a problem arose in 1968 when it was found that cracks had appeared in certain stainless steel components connected with the reactor vessel. This problem also occurred in a similar plant built at Oyster Creek, New Jersey. A programme of repair and modification was carried out at the expense of the contractor. Mainly as a result of this problem the completion of TAPS was delayed to October 1969, in which month it came to full power and produced commercial electricity for the first time. In compensation for the delay GE paid damages of Rs. 1.2 million. However, a bonus of Rs. 26 million was paid to GE on account of the net electric output being rated higher than specified in the contract (400 MWe rather than 380 MWe).

Operpting History

The Tarapur reactors have earned the distinction of being labeled the distiest reactors in the world" This designation is amply justified by a quick glance at its operating history. Radiation contamination of the reactor building and its environs has been hundreds of times higher than the design intent. Consequently, the radiation dose received by workers has been extremely high. In the initial years, TAPS was manned by a few hundred workers, (560 in 1970) who received a collective dose of 153 rems. In just a few years, the number of workers had increased sevenfold and the collective dose they got had also jumped ten times to 5,057 rems in 1977. The reason for the expansion in the regular workforce and the explosion in the population of 'casual* workers has been the need to keep occupational doses within internationally accepted limits set by ICRP. A comparison of radiation doses received by workers in Tarapur compared with dories received by workers at Dresden-1 plant (which was the 'prototype' plant whose technology was almost ten years older,) is shocking Over the years 1960 to 1970 exposure level at Dresden-1 normalised for electricity production were ten to fifteen times lower than those at TAPS,

Other' objective' criteria like capacity factors, the rate of forced shutdowns, 'unusual incident rate'. the amount of high level radioactive wastes stored at the station, the amount of low-level radioactive waste discharged to the environment, the amount of average 'down' time of the reactor, etc. all show that TAPS fares poorly in comparison with U.S. reactors of the same Vintage' However, since the performance of other Indian reactors of the CANDU type has been even more dismal, Indian nucleocrata have a great fondness for TAPS and are inordinately proud of it.

In 1984 unit-2, and in 1985 unit 1 of TAPS were both officially 'derated' to a capacity of 160 MWe each This was done because ofT irreparable leaks in the secondary steam generators which were isolated and taken out from the system. However, as a result of this, the moisture content of the steam has increased inside the turbines and has resulted in extensive corrosion/erosion of turbine parts including the blades. Erosion problems are not a new phenomena at TAPS, and had begun to appear even during the preliminary stage of reactor operations.

"Not A Quality Product"

TAPS reactors were built at the same time as the reactor at Oyster Creek in New Jersey, U.S.A The Oyster Creek plant suffered the same problems of cracking of stainless steel components of its reactor vessel that delayed Tarapur Thus, a look at Oyster Creek's performance in the U.S. context and its comparison with TAPS can provide a useful insight. Below we quote from a recent assesk ent of Oyster Creek brought out . a briefing paper by Nuclear Infomtion and Resource Service.

Oyster Creek is lagued by a history of poor operai ng performance and high operatioy and maintenance costs. According to the U.S. Department of Energy, the routine day-to -day expense to run Oyster Creek over a two year combined average for 1990 and 1991 was over 105 million, ranking it the fifth most expensive reactor to rate payers at $ 162 per kilowatt.

The New Jersey Department of the Public Advocate, Division of Rate Counsel concluded in July, 1990 testimony before the New Jersey Board of Public Utilities that, based on the historical operating performance and costs of the Oyster Creek reactor, "early retirement of the plant and the installation of replacement power would be less expensive to the rate payer than continued operation through the remainder of its planned service life" by as much as $ 1 billion if it were shut down today.

Oyster Creek is one of the most radioactively "dirty" nuclear reactors in the country. From 1988 to 1989, the reactor ranked highest in the nation for worker exposure to radiation, and third highest in the nation with the combined averages for the years 1990 to 1992. Oyster Creek routinely releases radioactive gases and particulates as part of its normal operations. According to NRC documents, nearly all of these releases to the environment are deliberate, ranging from 249 curies in 1989 to over 1 million curies in 1979.

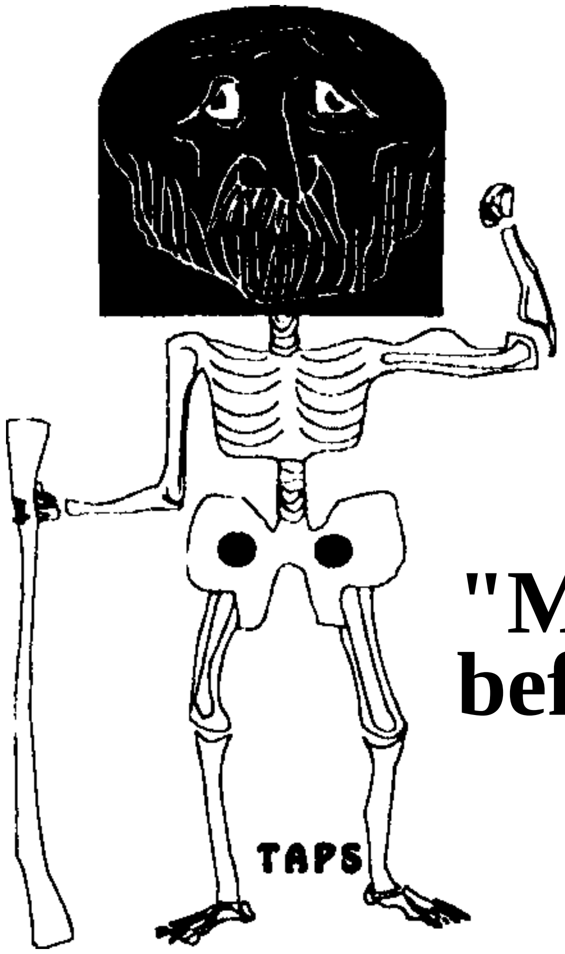
The Nuclear Regulatory Commission (NRC) has identified Oyster Creek as one of fifteen reactors where the reactor vessels are so weakened by radiation that the reactors'safety have been called further into question. NRC now believes that Oyster Creek may be susceptible, along with other GE Mark 1 reactors, to cracking of certain reactor vessel internals as a result of high radiation exposure. Two Mark l's in North Carolina were discovered to have cracks in the reactor core shroud which under certain conditions could shift and prevent the control rods from shutting the plant down. These cracks are obvious signs of premature aging that further indicate the need to retire these reactors.

A containment that does not contain

In an effort to gain a cost competitive edge, GE decided to build a smaller containment building than its rivals, opting for a "pressure suppression" system which tiades off large containment buildings for pools of water under the reactor designed to condense steam buildup during a core melt accident. This design has caused concern among regulatory officials, as studies have shown that its containment is virtually certain to fail during accident conditions in "as early as forty minutes." In fact, in 1986, the former head of the Nuclear Regulatory Commission (NRC) office of Nuclear Reactor Regulation, Harold Denton, told an industry trade group that there was a 90% probability that the Mark 1 containment would fail in an accident involving a core melt accident.

As early as 1975, three General Electric engineers wrote an internal report highly critical of their own company's nuclear reactors. The Reed Report, as it became known, was kept secret by GE and the NRC until 1987, when it was released under pressure of state and local governments and safe energy organisations. The GE engineers detailed dozens of safety and economic problems with the reactor design, concluding that GE reactors are "not a quality product."

However, Oyster Creek performance using the objective criteria mentioned earlier, shines in comparison to that of TAPS.



"Miles to go before I sleep"

A Potent New Danger

Lethally radioactive and thermally hot nuclear waste in the form of irradiated fuel rods from commercial reactors is being stockpiled in ever increasing volumes at nuclear power plants in the absence of a viable technology for its long term management. These radioactive fuel rods are removed from the reactor core and placed underwater in large storage pools to cool the fuel and to shield the environment from the intense radiation. Many reactor sites now have exceeded by several times the original design capacity of their storage pools.

On October 1, 1993 David Lochbaum and Michael Prevatte, two engineers working to raise the power output of a similar Boiling Water .Reactor at Susquehanna, Pennslvania formally presented findings to the NRC that potentially affect all Boiling Water Reactors (BWR) in the United States as well as a number of GE BWRs overseas. Lochbaum and Prevatte found that in general, GE's Boiling Water Reactors have serious design defects for handling loss of coolant water to the fuel pool associated with a credible Loss of Coolant Accident (LOCA) in the reactor.

These defects can produce potentially catastrophic results, including:

- The melting of the fuel in the pool which is located outside reactor containment.
- The failure of the reactor vessel and all reactor building safety systems.
- The failure of all radiation containment systems.
- The Loss of Off-Site Power (LOOP) associated with a LOCA or a combination of these events at the reactor which could lead to the boiling of the coolant in the fuel pool. As one example, the activation of the emergency core cooling system (ECCS) forcing water on a super hot reactor core would create a large hydrodynamic force (much like experiencing a giant "ting" in a home hot water radiator) in the steam suppression system of the plant, essential feed water pipes to the fuel pool are not seismologically qualified to hold up to postulated forces generated by this hydrodynamic force and could break, additionally, Lochbaum and Prevatte identified other design deficiencies involving the power systems to the fuel pool cooling and makeup water pump system that could be de-energized by a "load shed" mechanism associated" with a LOCA. In many reactors, like Susquehanna, plant operators would then need to open manually operated valves to provide emergency water to the fuel pool. The radiation fields could be on the order of 5000 rems/hr, posing certain death to operators attempting these "heroic measures." The resulting failure of this system would be the boUing off of cooling water to the irradiated fuel storage pool and the meltdown of several hundred tons of irradiated fuel /nuclear waste, resulting in an unanalysed catastrophic release of radioactivity off-site to the environment.

The boil off of the fuel pool cooling water itself would further challenge additional plant system design deficiencies. For example, the heating, ventilation, and air conditioning ductwork for the reactor building is not designed to handle the large volumes of condensation created by the boil off, causing the system to fail because of condensate accumulation or blockage. Safety equipment in the reactor building is not qualified for the temperatures and water collection potentially resulting from the failure of this sys n. Lochbaum and Prevatte cone ded that in a rapid cascade of events, safety systems would then fail, resulting in the melting of the reactor core, failure of the reactor veesri, failure of primary and secondary ontainment, and ultimately release of catastrophic amounts of ralioactivity to the environment.

The two engineers have urged the Nuclear Regulatory Commission to order the "backfit," or repair, of the Susquehanna reactors and perhaps 30 other reactors of similar design

A Pox on MOX

Instead of quietly celebrating completing 25 years of operation and closing down the reactors forthwith, Indian nucleocrats have decided to continue this folly further. They have spurned an excellent excuse for shutting down the reactors since the French who had been supplying the enriched uranium fuel till now have decided to no longer continue to do so. The decision to replace some of the enriched uranium fuel which is not available in India, with Indian manufactured Mixed Oxide (MOX) fuel is an act of unprecedented criminal irresponsibility

There are problems galore with MOX. Here we mention just a few of them.

- Manufacture of MOX fuel elements leads to higher radiation doses to operators than does manufacture of uranium fuel This is mainly due to the neutron radiation from Pu-inotopes and to the gamma radiation emitted by Americium-241, a daughter product of Plutonium-241. Furthermore, there is the risk of plutonium inhalation if leak tight containment of plutonium is not strictly maintained at all stages of the manufacturing process.

- During ' roceasing and fuel fabrication the risk of plutonium theft , particularly high. During those stages, plutonium is handled and processed as a solution or powder, in quantities of several tonne per year. Current systems of physical protection and material recounting are not sufficiently efffective to prevent the "loss" of several kilograms of plutonium per tonne during the process; they are not even sufficiently accurate to detect such a diversion with reasonable certainty after it has taken place.

- The transport of fresh MOX fuel also constitutes a significant security risk. Two typical fresh BWR-MOX fuel elements, for example, contain more plutonium than is required for the construction of an atomic bomb. And separation of plutonium from fresh fuel rods is much easier than the reprocessing of spent fuel. Fresh MOX fuel could therefore be a highly attractive target for criminal or terrorist groups, or for the agents of states wishing to obtain plutonium. These considerations also apply to the transport of plutonium oxide, which has to be transported, after separation, from the reprocessing plant to the MOX fuel fabrication site.

- The use of MOX fuel in BWRs which were originally designed for uranium fuel only creates additional difficulties. The regulation of the neutron flow in the reactor is made more complicated, in particular due to the neutron absorbing effect of several Plutonium isotopes and Americium-241. The effectiveness of the neutron absorbing control rods is consequently reduced. In order to compensate for this effect, the number of control rods must be increased. There are also a number of further potential safety problems which require compensatory measures as the proportion of MOX in the core increases. The result is that only a maximum of about 30-60% MOX fuel can be loaded into a reactor core under present circumstances.

- Spent MOX fuel is more difficult to transport and store than spent uranium fuel. Due to its higher actinide content, the neutron radiation emitted from spent MOX fuel is much more intense. Even in shielded transport containers, the dose rate at a distance of 1 metre from the transport cask is about twice as high for spent MOX fuel as for spent uranium. This leads to higher radiation exposure not only for transport workers and security staff accompanying the casks, but also for people living along the transport routes.

- MOX also creates additional problems in the final disposal of its waste. The long-term toxicity of the wastes from MOX reprocessing is higher, as is their rate of heat generation. High-level waste from MOX fuel emits about 7 times more heat, per tonne of spent fuel, than does high-level waste from uranium fuel. In the case of direct disposal, without reprocessing, spent MOX fuel generates about 5 to 6 times more heat than spent uranium. Much larger volumes of rock are therefore required in an underground repository in which to position MOX waste or MOX fuel in order to avoid excessively high temperatures, in any case, plutonium recycling in BWRs cannot go on indefinitely. With each cycle, the plutonium becomes more contaminated, and its isotopic composition less favourable. Hence, MOX fuel will have to be disposed of directly anyway, after two *or* three cycles at the most.

- The fact that so many safety and engineering problems are associated with the use of MOX fuel also leads to the inevitable consequence that its use in BWRs is much more expensive than ordinary uranium. Additional shielding and control measures for processing and handling, extra precautions against incorporation of plutonium (for example by inhalation of contaminated dust), as well as extensive security measures all add up to high costs.

A New Era of Hindi-Chini Bhai Bhal

In all the highly glowing accounts of the ingenuity of Indian scientists and their great contribution to the cause of ' self reliance', nobody has seen fit to mention the fact that MOX fuel cannot replace more than 30% for the enriched uranium fuel which was being imported from France and for which there is no available local substitute. What is TAPS going to use for the rest? U.S. and France, who had been supplying the fuel till recently have now declared that they have no intention of supplying till India signs the Nuclear Non-Proliferation Treaty and accepts full-scope safeguards with IAEA inspectors snooping every corner. Recent reports in the Nucleonics Week, the nuclear industry trade journal suggest that it is our old long-lost friends, the Chinese who have assured us that they would step in to fill the breach. Politics, it is said makes strange bedfellows. Nuclear policy makes them stranger still.

Surendra Gadekar
Based on reports from Nuclear Information Resource Service, Nuclear Engineering International, Greenpeace and Nucleonics Week

Aging Problems of Indian Nuclear Plants

An Official View

Our craze for 'phoren is absolutely astounding. Not only do we crave for foreign goods and marry our daughters to foreign returned bridegrooms; not only do we try ingenious tricks to immigrate to foreign shores and in lieu of success in these endeavours watch foreign TV programmes; we give serious consideration only to foreign criticism. Recently, a U.S. TV network, CBS, broadcast a film on India's nuclear power stations entitled "Another Chernobyl?" The film described the Indian nuclear programme as the most dangerous in the world and cited numerous 'instances' of unsafe operating practices at Indian nuclear power plants. It is a sad commentary that this one programme on a foreign TV network has raised more comment in the Indian press than all the reports on Rawatbhata and the BARC leaks put together. Below we reproduce the excerpts from an article by Dr. AGopalakrishnan regarding the defects besetting the Indian nuclear programme. The fact that nucleocrats are now willing to publicly admit that all is not hunky-dory with the programme and even the head of the nuclear establishment Dr. RChidambaram is now pleading for extra funds on such pusillanimous grounds that "the gains made with such efforts in the past should not be allowed to be frittered away", is an indication of the paradigm shift that has already taken place.*

Aging of critical subsystems, structures and components in nuclear power plants, if not closely monitored and checked, could lead to incidents which might have an adverse impact on public health. Let us see what is the status of a comprehensive list of safety-related critical structures, subsystems and components in our Nuclear Power Plants.

In the case of the Tarapur station, there seems to be a somewhat complete list on which everybody (researchers, designers, operators and regulators) agrees. Of course, these are General Electric Boiling Water Reactor (BWR) Stations for which similar information is available from elsewhere for comparison and everything seems to be in good shape. As regards the other 235 MWe Pressurised Heavy Water Reactors (PHWRs), discussions indicate that there is not much of a consensus on the total list among any of the groups, even though everyone agrees on most of the major and obvious constituents such as the pressure tubes, calandria tubes, containment, emergency core cooling systems etc

Unit-2 of the Rajasthan Atomic Power Plant (RAPP 2) and both the units of the Madras Atomic Power Plant (MAPP-1&2) have seen the highest full-power years of operation. A matter of concern in these reactors is the sagging of the pressure tubes. The pressure tubes contain the fuel bundles and the safety concern arises from the fact that such Bagging could lead to contact between the pressure tubes and their reactor vessel tubes, causing enhanced hydrogen embrittlement and the failure of the pressure tubes. The indirect monitoring of the gaps between several pressure tubes and calandria tubes in RAPP-2 has shown the possibility that in several channels the likely contact may have already occurred. Complete in-service inspection of all suspected pressure tubes is currently on.

A great deal of meeting of minds is required between the Bhabha Atomic Research Centre (BARC) and Nuclear Power Corporation (NFC) teams on what are the major safety related issues in the pressurised heavy water plants The vagueness and incompleteness which appear to exist in this area can be removed quickly through collective effort.

Environment and stresses in reactor systems are not easy to characterise. Instrumentation and sensors exist only in limited locations, and in the older plants some of these may be in a non-repairable state. There is very little option but to examine in detail the plant data records, and take help of analytical interpolation between the transient variations in known locations through the use of plant dynamic modelling. A reasonably good model has been developed by the NPC, which is presently under verification. Again, there is need to create a careful data bank of environmental changes and associated list of specific stressors which each critical item of each nuclear power plant unit has seen, from the beginning to the present. This is a somewhat painful task now, since such details may not have been kept track of. All the same, creation of this essential data base can no longer be avoided

One often Hi rs statements to the effect that "cob. -benefit aspects" of safety should also be kept in mind by regulatory agencies. If these are to mean that safety stipulations should only be insisted to the extent they can be implemented inder the existing financial constraints of the nuclear facility owner, talking into account the difficulties in getting suitable imported spare parts and indigenous technologies, it just cannot be agreed to. The larger "cost" of potentially impairing the public health and safety should be **the** predominant concern. There can be no negotiation or compromise on lowering the safety standards and norms below internationally acceptable levels, in order to accommodate the unfortunate limitations faced by the facility owner.

Aging related work is of growing importance and it should certainly receive emphasis and larger diversion of funds as time progresses. The formation of a multi-disciplinary task force comprising the NPC, the BARC/IGCAR (Indira Gandhi Centre for Atomic Research) and the AERB, on a full time basis, who can be entrusted with devising a definite and well-knitted programme of activity, should be considered.

Dr. AGopalakrishnan
Atomic Energy Regulatory Board

The Dark Heart of the Nuclear State

The following are excerpts from an article "Burning the house to light a dinner candle" which appeared in a Pakistani newspaper The News.

The peaceful nuclear programme in Pakistan is supposed to be directed towards using nuclear power to generate electricity. The early promise of cheap (perhaps even free), safe, unlimited electricity produced in nuclear power stations is now like a fairy-tale. It stands revealed as a bar gain with the devil, selling the future for the gratification of the here and now. Using nuclear power to make electricity is like burning down your own house to have light to eat your dinner by. (The same image can be used to view nuclear weapons. They amount to soaking yourself and your family in petrol, lighting a match, and saying come on then attack me if you dare.) These aspects have become so clear that nuclear power is on the run in the very countries that pioneered the technology and developed it.

As if intent on repeating every mistake that has ever been made the Pakistani state machine pursues a "nuclear programme" and justifies it in the same tired old western terms. The debate on this issue in Pakistan is restricted. It is as if everyone taking part in it had accepted a set of limits as to what can and cannot be said, and since the limits of debate are set in advance it is no surprise that the same old arguments go around. The reasons given for pursuing the nuclear power programme the raw material, Uranium is in relative abundance compared to oil and gas. Secondly, the power generation process in reliable com} ared to hydroelectric (no load shedding). Thirdly, it has a positive effect on the scientific and technological capability of the state. The acute problems concerning the radioactive contamination of people, of land, air and water for time scales much longer than any other human effect on the environment, which have effectively killed off the nuclear programmes in most Western countries, merit little attention in Pakistan.

Why then, despite the worldwide catalogue of disasters and tragic experiences with nuclear programmes, does a country like Pakistan persist in its "nuclear capability"? In part it is because there is so little real informed debate. How much public debate has there been, for example, on the 300 MW nuclear power station to be built by the Chinese at Chashma? How many people know that this is the only Chinese designed reactor, that there is only one like it in China and that too is only at a trial stage? This design has no history of reliable operation and consequently no-one has experience with its operating characteristics, it is worth thinking about that the Chinese nuclear are relying on reactors build with foreign technology for use in China, rather than using their own design.. Is Pakistan a test-site for Chinese nuclear technology? If anything goes wrong who will pay the price?

The Pakistani nuclear programme is sheltered close to the heart of the state, it is controlled through the Atomic Energy Commission by the Prime Minister's Secretariat, the light of accountability is never allowed to shine in on it. There may be several reasons; perhaps it's because nuclear physicists are such delicate flowers and need to be protected and sheltered; or perhaps it's because those kind, thoughtful people don't want to burden us with all that nuclear physics, which is really too hard for the rest of us to understand. Whatever the reasons, in this darkness, away from the public gaze fierce monsters breed and grow fat and claim, like dragons, to guard a great magical treasure. This is common to all nuclear programmes. All "they" have to do is say the magic words "the National Interest" and everyone goes quiet.

Dr.Zia Mian
The News February 3,1994

The Risks of Old Reactors

On September 21, 1990, the operator at Tennessee Valley Authority Sequoyah Unit 1 nuclear power plant heard something that sounded like a freight train. Seventeen days later the plant was shut down after X-rays revealed that the disc of a check valve in the main steam line was missing. Such check valves are used to prevent reverse flow of steam into'the containment building in the event of a steam-pipe break. The 28-inch diameter disc, weighing several hundred pounds, had broken off and gone bouncing through the main steam pipe. Inspection of the other three check valves in the main steam lines to the turbine showed that two other discs had also broken off.

The Aging Process

Sequoyah Unit 1 is only 12 years old. Yet the check valve incident resulted from age-related degradation of the nuclear plant equipment-degradation that went undetected by routine testing and inspection measures.

The U.S. Nuclear Regulatory Commission (NRC) defines aging as the cumulative degradation of structures, systems, and components over time. Factors that contribute to the aging process include normal wear and vibration; improper installation, use, or maintenance; and conditions under which the system or components have operated. If the effect of aging go undetected or unchecked, they could lead to equipment failures, accidents, or other abnormal plant conditions that could jeopardize safety.

Two major safety problems can result from nuclear plant aging: The probability of an accident (such as a pipe break) can increase, and the probability of the failure of safety systems (such as emergency core cooling) can increase, as well. Age related deterioration of equipment can also result in accidents that are more severe than the safety systems were designed to handle.

In theory, the adverse effect of aging can be corrected by maintenance, repair or replacement of the affected components. For this to successful, however, the causes of the aging must be known; testing and inspection must be capable of detecting the age-related degradation; and the costs of the additional maintenance, repairs, and replacement must be economical enough to warrant continued operation of the plant.

The NRC and the nuclear industry claims that the causes and effects of aging are understood and that routine testing and maintenance are adequate to detect and correct these effects. In 1989, however, the US General Accounting Office reported to congress that:

- **Neither the NRC nor the nuclear industry fully understands the nature and effects of aging on nuclear power plants;**
- **The operating and maintenance practices of each utility are different.**
- **Each plant has a unique history of operating conditions and minor accidents that can accelerate aging by inadequate maintenance, improper testing and abnormal operating conditions.**

In addition, the experience in nuclear plants shows that aging is increasingly the cause of accidents, equipment failures, lengthy plant shutdowns, and expansive repair, and that current testing and maintenance practices ire inadequate to prevent age-relat d failures.

Failures Due to Aging

Many mechanisms contribute to the deterioration of nuclear plant equipment, and virtually every component in a plant is degraded by one or more of those mechanisms. Different types of aging degradation include and sliding surfaces, which can be accelerated by inadequate lubrication, use of an incorrect lubricant because of temperature or contaminants; equipment fatigue caused by vibration or periodic cycles in temperature or pressure, erabrittlement and loss of toughness in the reactor pressure vessels from neutron radiation. Unfortunately, the NRC's program of age- related research covers only about 25 percent of the major equipment important to plant safety and will not be completed until the mid-to late 1990s. Two components affected by aging are emergency diesel generators and check valves.

Emergency Diesel Generators

Emergency diesel generators provide electrical power to run a nuclear plant's safety systems. In the event of reactor shutdown and a loss of main electrical power, the diesel generators must start, achieve rated speed and voltage, and begin supplying power to the plant's safety systems in less than one minute.

Although there are more than 200 diesel generators in use as emergency power sources in US nuclear plants, the complexity of the diesel-generator system and the lack of standardization makes it difficult to use experience in one plant as a means of predicting failures due to

aging in a)ther in plant. From 1965 to 1984, there were over 2,000 reported failures of diesel generators, according to a review conducted for the NRC by Pacific Northwest Laboratory. About t half of the failures appeared to be related to some form of aging degradation. Analysis showed that as plant age increased, so did the percentage of diesel generator failures due to aging. The primary causes of aging failures in the diesel-generator system are vibration, inferior quality of components, adverse environment, and human error during maintenance.

Check Valves.

A check valve is designed to open and allow flow through a pipe in only one direction. When the flow stops or reverses direction, the check valve closes. Several hundred check valves are used in a typical nuclear plant, in both the safety and plant operating systems. Failures of check valves have resulted in water hammer (a condition in which water rapidly fills a void in a pipe then goes slamming against the end), over pressurization of low pressure systems, and damage to other system components. These failures have been caused by severe degradation of hinge pins, hinge arms, discs, and disc nuts. Many have been attributed to tapping of flutter of the check valve discs: When the flow velocity through a check valve is insufficient to cause the disc to reach the fully open position, disc flutter and tapping can occur. The flutter may cause rapid wear of the hinge pin and tapping against the backstop can generate significant impact forces that may result in fatigue of the disc stud.

Neither the regulators nor the nuclear industry fully understands the nature and effects of aging on nuclear power plants

Even if the check valve is properly designed for normal flow conditions, changes in plant operation can result in rapid wear. In November 1985, for example, in San Onofre Unit 1 in southern California, a severe water hammer extensively damaged a portion of the feed water system because five check valves had failed. The disc stud/nut connection in these check valves had fractured because of repeated impact against the open stop. Although these valves had operated satisfactorily for several years at full power, 15 months prior to the water hammer, plant power had been reduced to 85 percent. This resulted in insufficient flow to keep the discs fully open, causing repeated impacts against the stop and eventual failure of the threaded connection.

Unfortunately, the procedures used to test check valves cannot always detect conditions that could lead to their failure. Some check valves cannot be tested while the plant is running because of the adverse effect the testing would have of plant operation And some can never be tested at the required conditions because of the design of the system in which they are used.

Because of weaknesses in periodic testing and the inability to ever test some check valves, utilities periodically disassemble and inspect them. While disassembly provides good information about the condition of a check valve, it has some drawbacks. Aside from the cost and worker radiation exposure, reassembly errors can go undetected in valves that cannot be tested for reverse leakage or cannot be tested under the full flow conditions required during an accident. The NRC research program is attempting to identify methods of determining check valve conditions that would not require disassembly.

One aspect of check valve performance that is not tested and that will become increasingly important as plants age is their ability to withstand the force of rapid closure. If the piping upstream of the valve fails, the flow in the system will reverse rapidly, slamming the check valve closed. If it has degraded because of corrosion, thermal or mechanical fatigue, or other aging effects, the impact of the disc on the seat could rupture the valve, allowing a continuous reverse flow through the valve It is doubtful that the capability of an aging check valve to withstand such a rapid closure could be demonstrated prior to licensing of a nuclear plant. Yet the NRC's aging research program apparently is not investigating the effects of aging on this aspect of check valve performance.

Why Aging is Important

Less than 15% of the nucler plants in the United State have been in operation for more than 20 years, and only 2 small demonstration plants have operated for about 30 years. (One of those, Yankee Rowe, was permanently closed in 1992.) Thus, the nuclear industry has very little experience with aging effects on plants that have operated for even half of their 40-year design life, much less years longer.

Robert D Pollard
The Nucleus Summer 1992
Union of Concerned Scientists

What Rawatbhata Can Learn From Chernobyl Related Research?

A paper entitled *Female Reproductive Function in Areas Affected by Radiation after the Chernobyl Power Station Accident* By V.LKulakov and 14 others has been published in *Environmental Health Perspectives* (Vol.101 Supp.2 Pages 117-123 [1993]). The paper reports the results of a comprehensive survey of the effects of the radiation released from Chernobyl in 1986.The paper concentrates on evaluating pregnancy outcomes and health risk to women and the consequences of the accident on the health of the progeny. The study is restricted to two well defined areas: the Checher-sky district of the Gomel region of Belorussia and the Polessky district of the Kiev region in the Ukraine. The results of this study are of special importance to us in India since they show remarkable similarity with the findings of the health survey carried out in the environs of Rajasthan Atomic Power Plant at Rawatbhata.

The Results:

The methodology of the survey involved extensive medical examinations and follow-up cases for up to five years after the accident. While records of almost 7,000 labour histories were examined, detailed medical examinations were carried out on 688 pregnant women and their babies. The studies were carried out for a period of eight years, three years prior to the accident and five years after the accident.

The most important difference between this study and the Rawatbhata health survey, concerns the fact that while Chernobyl was a catastrophic accident, with serious contamination of air, water, soil and food, There has been no known accident at the Rawatbhata site and the officials have always claimed that the contamination of the environment and the food chain is 'negligible' and well within internationally accepted limits.

Health of mothers, fetuses and children badly affected in regions around Chernobyl

Deformities four times higher than before the accident

Disease resistance decreased

There are many striking similarities in the results of both the studies: One, a sharp increase in the number of congenital deformities. In one of the districts covered by the study, there was a four-fold rise in congenital abnormalities. Contrast this with Rawatbhata where one sees a three fold increase in the number of congenital deformities in the population showed an increase by a factor of three as compared to a control population. And children born after both the reactors started operations are more than are five times more at risk of being deformed.

Another common strand in the suffering of people tear Chernobyl and Rawatbhata is the reduction in immune response. While at Rawatbhata, this loss of the body's repair mechanisms was seen by a marked rise in chronic infections like tuberculosis, intractable skin, gastro-intestinal and respiratory problems, the same phenomenon has been directly seen at Chernobyl by measuring immunoglobins in the blood.

Kulakov and co-workers have done an extensive study and they find many other health problems with pregnant mothers, new born babies and children. They find that mothers during pregnancy were more prone to suffer from anemia, thyroid dysfunction, placental insufficiency and hypertension These diseases though not directly related to pregnancy, piny a very powerful role in determining the pregnancy outcome. More commonly known radiation related effects, like platelets aggregation surrounding blood cells were also observed.

One of the major benefits that researchers in India can derive from this paper is that it gives a very fine methodology that can be followed to determine the health effects of low-level radiation. In a future follow-up study in Rawatbhata it would also be good to perform biological dosimetry by counting dicentric chromosomes, and do radiation monitoring of air water, soil and food samples.

Sanghamitra

Testament of faith

Letters from Nuclear Protesters Awaiting Sentencing

GreetingB, Friends.

John Dear, Bruce Friendrich, Phil Berrigan and I acted December 7, 1993 to expose and disarm one weapon of U.S. nuclearism, an F-15E fighter bomber, in readiness at Seymour Johnson Air force Base, north Carolina. Three of us, acting on strong religious beliefs, and I, with strong secular spiritual belief, poured blood and hammered on this bomber to speak truth through action, and to resist militarism and oppression. We acted to concretely disarm a plane which was already used to slaughter Iraqis and which will likely bo used again to slaughter Koreans, or Bosnians (Serbians, Muslims and Croatians alike). We acted to help stop the warmaking madness; to alert and educate the people of North Carolina to their economic dependence on oppression and murder. We acted because our consciences required us to act (in the loving tradition of thousands before us)...

As I awaited this trial separated from my acting community as the only woman among us, I spent long hours considering war, oppression, exploitation, imperialism and death, as well as peace, nonviolence, resistance, economic justice and love. I'll offer just a couple of my very basic conclusions: if you value life, you do not build trillion dollar arsenals for the sole purpose of eliminating it. If you respect life, you do not allow those trillions of dollars of resource to be stolen from the sick, the poor, the dispossessed and our children. If you love life, you do not allow anyone, any power, to do these things in your name.

It is true I have mourned the precious moments, days, months, years stolen from all who are prisoners-for political, economic or psychological reasons, yet, I understand that my freedom is a very small sacrifice when millions throughout the world suffer the torture of our national collective inaction. And, i rejoice- because the action and incarceration of only four have already served to inform, motivate and encourage hundreds more, who will then inform, motivate and encourage hundreds more... to more serious resistance and justice, to greater commitment to concrete, status-quo shattering, creative social change.

Lynn Fredriksson

Dear Sisters and Brothers

...Recently, I read something that helped explain the frightful proliferation of violence in the U.S.-the multiplication of guns, shootings in the schools, more and more suicides, rapes and abuse of children, something seems to be driving us mad, as though we have decided to tear one another apart, decided that everyone is an enemy to be killed. What's behind all this savagery? Is it possible to identify the source?

Perhaps we can consider this. It is a fact that during and after the Vietnam War, American homicides jumped 42%. Isn't this the price we pay for killing millions of Indochinese? More to the point, isn't it inevitable that when the U.S. butchers people abroad, we kill one another at home? Is this the key to the bloodshed on our streets?

Yes on all counts, I would Bay. the government represents us; we pay for it and hold it; it acts for us collectively, when it destroys moral barriers in our name by carpet bombing of Hiroshima and Nagasaki, by leading the nuclear doomsday race, by repeated interventionary war, by wars as our #1 business, these same moral barriers will plunge in our people. If the government cheapens life and attacks it ~ the people will also. We will begin to kill one another with a dreadful compulsion.

We must understand that this government will never admit to criminality, Hazel O'Leary notwithstanding, this government will never disarm its nuclear warheads or demobilize its military. This government will never take responsibility for carnage on our streets. Because this government is irresponsibility, injustice and cruelty.

So much for Washington. As for us, we must be responsible, and nonviolent resistance is the ultimate responsibility.

Resistance is to the American killing machine and its white collar killers. Resistance is to a criminal, insane government and to its killings.

Resistance is the best protection for ourselves, our children, our communities and our people.

In God's name then, and in our own, let us resist the killers and stop their killing.

Philip Berrigan
The. Nudear Resister
March 25, 1994

Whitewash in France

An "Independent" Inquiry Commission Submits a Blinkered Report

On the 22th of February 1994, the French government authorized the restart of the fast breeder nuclear reactor Superphenix (1200 MW) after three and half years of stand-by for safety reasons. This restart was refused in June 1992 because the safety of the installation was not "assured". Although the situation has not changed one bit since then, the pressure from the nuclear lobby overran all concerns regarding the safety of the population, or concern for democratic procedures.

From March to June 1993, a Public Commission of Inquiry investigated the possibility of restarting the reactor. This was demanded by the operating company, NERSA, in October 1992. The Commission published a report which was made public on September 30th, 1993.

The public was allowed to present evidence to the commission and this was largely done. The Commission received 29,412 depositions. Of these, 96% were opposed to the restart of the reactor. The "commissioners" declared that they had no competence on the subject of nuclear technology, but instead of examining the evidence, they asked the NERSA company itself to write the technical aspects of the report. The Commission totally ignored the opposition from various sources including elected representatives, independent technicians, local residents, etc The report does not even give the opinions of the Minister of Environment, national and official institutions like the Social & Economical Council and the Nuclear Information & Safety Superior Council. The Commission has thus fully collaborated with the nuclear lobby to bring out a report which protected its interests.

Mr. Pronost, a member of the Commission, was invited to visit nuclear reactors in Russia and Japan. His visit in Russia gave him "a good impression" and he reported that the fast breeder at Beloyarsk (BN 600 MW) is "in a good state", and that "Russian technicians monitor fully the technics of this kind of reactor". However in fact, in the beginning of 1991, 600 kg of sodium caught fire and three days were needed to put it out, and the fire resulted in a collective irradiation dose of about 200 man-rem. In Japan, he met only nuclear technicians and, therefore according to him "there is no ecological opposition in Japan". Which is patently false, since Japan has a strong and growing antinuclear movement which has organised large national meetings against the fast breeder reactor of Monju (280 MW) in October 1993.

The Commission said that it was not competent to decide on questions of economics, technical problems and safety questions. One wonders what was within its competence?! Moreover, the questions concerning economics, laws, energy choices, nuclear wastes and nuclear in general "were not within the frame of "terms of reference" of the inquiry". Of course, the numerous accidents and incidents at the site since the reactor started in 1986 were not within the frame of its competence ! For the Commission, Superphenix was "the best energy producing machine in the world". It would all be hilariously funny if several millions people ware not within the range of possible irradiation in case of a serious accident.

In December 1993, a meeting of the Parliamentary Office for Scientific & Technical Choices was organised to inform the members of the Parliament regarding the question of restarting the Superphenix nuclear reactor at Creye-Malville. But strangely, no parliamentary debate has ever been conducted regarding the original starting of the reactor since the project was planned in 1976.

Currently some of the unresolved outstanding problems of safety are :

- No safety evaluation of the reactor under actual operating conditions exists.
- The fact that under accident conditions the reactor core can rearrange itself and the heart of the reactor can explode like a nuclear bomb.
- The difficulties regarding use of sodium; and controlling fires of sodium
- Difficulties of intervention inside the containment.
- The operators are not regulated properly and have in the past taken too long to analyze unusual incidents and accidents which have occurred frequently.
- Superphenix produces wastes for millions of years, which we do not know what to do with.
- Superphenix produces weapon's grade plutonium (several hundreds of kilograms since it started in 1986), which contributes to the proliferation of nuclear weapons.

We have fought a long, seemingly never-ending campaign against the new reprocessing plant THORP, the startup of which, although built, we managed to delay for nearly 2 years. We did everything possible, rallied international support, took the Government to court, but ultimately had to accept that big money speaks louder than common sense or concern for the health of the population and that there is no justice.

I often think about the Berlin Global Radiation Victims Conference, meeting you and it seems a lifetime away. Hearing all those testimonies and evidence then and hoping that something dramatic would come of it and looking around what is happening in Britain now, the way the nuclear industry is managing worldwide to steer research away from radiation biology and relying on epidemiological studies to prove that all our problems are caused by viruses and the racing about of workers all over the place is really quite frightening.

I get so angry when I see all this dishonesty, eminent scientists who seem to get 'bought[1] by large amounts of cash being poured into their departments to produce the 'right' results and in contrast others who seem to be doing exciting research into the effects of low-level radiation, being starved of funding.

No doubt, you are aware that we have lost the leukemia court cases which were based on the Martin Gardner theory, due to lack of supportive evidence. This has now been a sign for the nuclear Industry to claim that radiation has nothing to do with ill-health.

I read *your AnumukH* Journal with great interest and hope to use information from the special issue on Rawatbhata in our next 'Waste Paper', we've got to keep pushing the message and tell what is happening. I am enclosing some of our 'Waste papers' which are published quarterly and well put you on our mailing list for future issues.

Janine Allis-Smith
Cumbria

The visit of the AERB chief to Vedchhi is indicative that our long struggle for justice for the people of Rawatbhata is finally beginning to yield some fruitful result. The government has to recognise people's yearnings and I am sure that the future would bring brighter results.

Dr. Rampratap Gupta
Rampura

What Mutual Understanding is proposed to be built? That anti-nuke is right and pro nuke is also right? Where is the gray area where black and white come together? If you have any issues that could be included in such a gray area I would be pleased to know them.

Earlier we had people of the stature of the much respected Dr. Vikram Sarabhai, the second chairman of India's Atomic Energy Commission. He was a concerned scientist who could contain political bosses from giving directions to his department. The offer of a dialogue by Dr. A. Gopalakrishnan chairmen AERB, makes me apprehensive.

- Will the dialogue be open? Will it be fully reported in newspapers?
- What aboufclasaified information* under which everything that *"hurts'* is hidden?
- Has he the freedom to "blow the whistle?" If not how far will he go to lose his job?
- What are the guarantees against misusing our opinions and berating us as misinformed and misguided?

Allow me to quote Gandhi. In March 1922 he told judge Broomfield:

"1 am here therefore to invite and submit to the highest penalty that can be inflicted upon me for what in law is a deliberate crime and what appears to me to be the highest duty of a citizen. The only course open to you, the judge, is either to resign your post and thus disassociate yourself from evil, if you feel that the law you are called upon to administer is an evil and that in reality I am innocent, or to inflict on me the severest penalty, if you believe the system and the laws you are assisting to administer are good for the people of this country, and my activity is therefore injurious to public weal.[9]

Dr. A.Gopalakrishnan is a man with a family and friends and I am sure he wishes well for them. Will he be ready to say that these dear and near ones need not ever fear radiation from nuclear plants? Would he like any of them to handle the things that are being handled at the plants by casual labour? Or else will he be prepared to resign and joins the anti nuclear group?

May be you would not be "coopted", but what guarantee is there that you could not be used or misrepresented?

In spite of all that is said above, if you feel confident that there is some possibility of opening the door, I wish you God speed.

Shri Jyotibhai Desai
Vedchhi

I was glad to note that Dr. A. Gopalakrishnan came to you on fas own for a long discussion. It proves, (I do not think you need such proofs, no Gandhian does) that there are people on both sides of any fence who do not entirely belong there and are willing to discuss issues. One's background and sources of knowledge can always differ.

Dr. Pramod Moharir
Hydrabad

Why does Anumukti not publish research articles? I am in the process of writing a review article on human chromosome anomalies and aberrations due to damage caused by radiation and drugs. I am also trying to do genotoxicity teat of some chemicals on fishes through sister chromatid differentiation.

Dr. Ashok Barat
Allahbad

The reason Anumukti does not publish unadulterated research articles is because "genotoxicity due to sister chromatid differentiation" is Greek for most of us including the editor. However, we would gladly publish articles which have been written with the lay public in mind.

I got your address from your article in *Sunday Observer*. It was terrifying to read about the awful state of nuclear power stations in India. Just to ape the West, we are not only ruining our culture and heritage but our life as well. Nuclear stations are a franckenstein monster and any catastrophe could lead to another Chernobyl

Dr. Amit
Jhansi

It must be some kind of a record (Guineas Book, please note) to have three issues *of Anumukti* coming out in the span of less than one month. The February/March issue did come out in March and so it seems that you have finally managed to beat the clock. Congratulations. I was happy to read about Dr. Gopalkrishnan's visit. I would like to know more about what you talked with him. I feel it is a new opening and if talks like this continue to take place, it would be in the long term national interest. If there could be a platform from where both sides could place their Arguments as happened in Bangalore '88, that would be an important step forward.

Vinayak Dave
Gandhinagar

The pronudear side took such a beating in Bangalore, that they have forsworn any repetition. The antinukes are always prepared to meet the nukes for an open public debate any time any place.

Since you have asked for suggestions. I am taking the liberty to pen my thought. It may not be possible to incorporate everything that I say, but the points do require your attention.

- Please give small snippets which Are interesting, informative and appealing along with long articles.
- Opinions of well known scholars in support of the articles should also be presented.
- References to the facts and figures used in articles would be very useful.
- A cost-benefit analysis of big projects against small ones should be given.

Chandmalji Kanstva
Gandhinagar

RAPP (Rajasthan Atomic Power Plant) authorities had organised an ofT-site emergency preparedness drill on December 22nd, 1993. We had organised a protest for the occasion and reiterated our demand for a referral hospital at Rawatbhata The local administration gave us good support and even the Rajasthan state government put pressure on RAPP authorities. RAPP authorities have finally conceded our demand and given a building to host the referral hospital which will be run by the state government. There will be six doctors And 30 beds. The hospital has already begun functioning and these is some relief to the poor. In support for our demand we did cite the case of Kakrapar, where the nuclear authorities have fnven money to local educational and medical facilities, but it had fallen on deaf ears without pressure from tho public. The RAPP administration still continues in its effoits to hinder useful social work by instigating some greedy local people.

Hatanlal Gupta
Rawatbhata

I had been busy with the anti-Dunkal campaign in Delhi and hence could not write to you earlier. What has been the response from Rawatbhata? Only A few people would be influenced by the RAPP Authorities' public relation campaigns. If the work of awareness raising and organisation work continues unabated then people would realise their hitherto hidden united strength and greater pressure would he put on RAPP authorities, feel that in talks with Dr. Gopalak rishnan, A few local residents from Rawatbhata should remain present and at least some portion of the talks should take place in Hindi or arrangements should be made regarding simultaneous translations. I also feel further surveys should be conducted in the neighbourhood of Rawatbhata and the true position regarding health should be firmly established. We would like to be part of this survey team.

Sunil
Kesla

A Ray off Hope From Pakistan

Just before going to the press we received this letter from Dr. Zia Mian in Islamabad. I was thrilled with it, since it is the first time in many years of effort that we have received a communication from across the border which expresses the hopes of all peace loving people of the subcontinent lam sure that there are many who would love to reciprocate the sentiments expressed in this letter and I would urge them\o do so, not only in Anumukti but also in mainstream press. Dr. Zia Mian sent cuttings of five articles of his which added to my astonishment It was a revelation for me to realise that contrary to my impression the mainstream press in Pakistan is 'free'. I have yet to see such a forthright condemnation of the nuclear madness in any of the large newspapers in India. Due to lack of space we are not republishing a full article in this issue but we have an exerpts on page .

Dear Friend,

I am writing to you as part of an attempt to establish a dialogue on peace in South Asia. I am currently researching and writing on peace and security in South Asia as a visiting fellow at the Sustainable Development Policy Institute, in Islamabad. I also write a column in The News, a major English Language paper published in Islamabad, Lahore, and Karachi. I hope that after this letter you will wish to open up a line of communication between your organisation and 8DPI, as part of our contribution to this dialogue. Let me explain the motivation.

I believe that there are sizable minorities in India and Pakistan for whom the nuclear arms race between our countries is a symptom of a deeper malaise. It is this that needs to be tackled, but the issue of nuclear disarmament in the region can, in fact, help us address this. The important thing is for groups in India and Pakistan to make common demands, but to make them to their respective states, and to couch them in unilateral terms. For example, Pakistani groups should demand that their government give up the nuclear weapons programme, and be able to point to Indian groups that are making the same demand of their government. But both sets of groups should not accept a position that we will give up our programme, if you give up yours". It is these demands that need to be worked on together.

For me a crucial problem is the absence of information about the peace movement in India. Since I know how difficult it is to follow the debate on this issue in India, from Pakistan, and I presume it is almost as difficult for you to get access to the Pakistani media, I enclose a copy of some of my articles that have appeared in the press in Pakistan. I would be grateful for any material you may be able to send me.

Dr. Zia Mian
Sustainable Development Policy Institute
P.O.Box2342
Islamabad, Pakistan

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Floodwaters Drown Kakrapar

First there was fire. Now Water. The turbine building at Kakrapar atomic power station which was gutted in a devastating fire on 15th September, 1991, has now again suffered extensive damage due to floods.. Equipment worth crores of rupees has been devastated and the station is not expected to start functioning again for months. A Chernobyl-like catastrophe was averted only because as luck would have it the plant was in a shut-down state at the time.

The monsoon arrived in South Gujarat with a bang. There had been a few preliminary showers from June 10th onwards but nothing had prepared the population for the fury that was unleashed on June 15th and 16th. The rain continued steadily for hours together during which about 25 to 42 centimetres of rainfall was recorded in different talukas of Surat district. All the rivers and small streams of the area were in spate rising by metres within a few hours. Fortunately the rain stopped by the evening of June 16th and the waters started receding.

The scene they left behind was one of utter devastation. A thousand houses were demolished in Bardoli alone and many more elsewhere were damaged. Whole sections of roads, railway lines and bridges vanished into oblivion. Trees were laid low and farms turned into ponds. We (Sanghamitra and Surendra) were caught 100 kms from home and had to trudge back through rivers and streams and making long detours.

River Tapti runs east to west north of Kakrapar nuclear power station. There is a dam on the river at Ukai about 25 kms east of the plant and a weir at Kakrapar which is just one kilometre north of the plant. Just behind the turbine building there is the Motícher lake which has a gate to control flows at Ratania. The outlet ducts of the turbine building connect it to the Moticher lake.

As the rain poured on, the level of the water in the lake started to rise. By night fall on the 15th, it had risen sufficiently that the water started flowing from the lake towards the turbine building. The engineers on duty at the time took no remedial action. By the next morning the water had filled the underground room containing pumps, motors, cables, etc. which feed the boilers and are necessary for the regular recirculation of steam from the turbine to the steam generating section in the reactor building. Floodwaters had also spread to other sections of the reactor complex including the offices of the project director and the chief project engineer, the master planning group, the field engineering section, the Civil Job Section amongst others. The reactor building was mercifully spared. Computers by the dozen and hundreds of papers and flies were soaked in the slush. There was more than five feet of water near the main entrance and the workers of the morning shift had to swim inside. All the large storm drains in the area failed.

It was only by 11 O'clock, 16th morning that the authorities woke up and began remedial action. A site emergency was declared and all non-essential workers were evacuated from the reactor site. Other measures consisted of act ivating external pumps to drain the buildings and making efforts to get civil authorities to order the opening of the Ratania Gate so that the level of water in the Moticher lake could begin to fall. It was only on the 18th morning, after the waters had receded completely, traffic had resumed on the roads and a large pump was brought from Tarapur, that some success was achieved.

Unit-l of Kakrapar had been on a planned 72 day shutdown from 5th February, 1994. The plan was to check and replace the faulty turbine blades which had been the cause of the fire in the turbine room in Narora lastyear. (See Anumukti Volume 6 Number 6 June / July 1993.) It is worth recalling that at the time the chairman of the Department of Atomic Energy, Dr R Chidambaram, had claimed that the Narora plant would be operational within four months at the most. It is now 14 months with no sign of that happening. The shutdown at Kakrapar too had stretched beyond schedule and the unit was supposed to recommence generation on the 15th of June. Fortunately it didn't. If the unit would have been operational and producing steam, then a flooding of the pumps would have resulted in steam being pushed back into the reactor building causing overpressurisation and a large explosion as at Chernobyl.

Work on Unit—2 of Kakrapar has been proceeding rapidly and the authorities have been rather anxious that it becomes operational this year. (Just three years behind schedule.) Hopefully, the flood waters have drowned these aspirations.

The floods have once again demonstrated rather vividly the total failure of planning and the inadequacy of the administration in dealing with a nuclear emergency. Since the roads had been badly damaged due to floods, it was difficult for anybody to even get **to the reactor site. If there had been an off-site emergency, the authorities would have failed to evacuate even themselves leave alone the population. Even now, five days after the event, the civic authorities have not been able to provide relief to affected villages in the vicinity.**

South Gujarat is fortunate that unlike other areas of Giyarat, the rain gods still smile on it. Hopefully they would continue to do so every year. But even moderate rain today can cause havoc. 'Development' has meant large scale deforestation and the blocking of the natural drainage by roads, canals, railway lines and other constructions. Another large contributor to this has been the 'levelling* of agricultural fields. The natural systems which provided protection earlier have perished.

Rains, floods, cyclones, earth'quakes are 'natural' events. Planning for the nuclear plant should have taken all such factors into account. The floods have demonstrated the incompetence of the nuclear planners in a very striking manner. They are the people who cannot even design storm-drains properly Can the people continue to trust these 'experts[1]?

Surendra Gadekar

From the

How Many More Warnings Before the Final Curtain?

Just before a catastrophic volcanic explosion, there are many signs of increased volcanic activity. There are greater lava flows and more smoke and gasses from the cone, the frequency of small earthquakes increases perceptibly, etc. Examples abound of those who ignore these warnings and continue their business as usual lifestyle, ending up as victims of volcanic eruptions. Pompeii is a reminder of what happens to those who continue to sleep till it is too late.

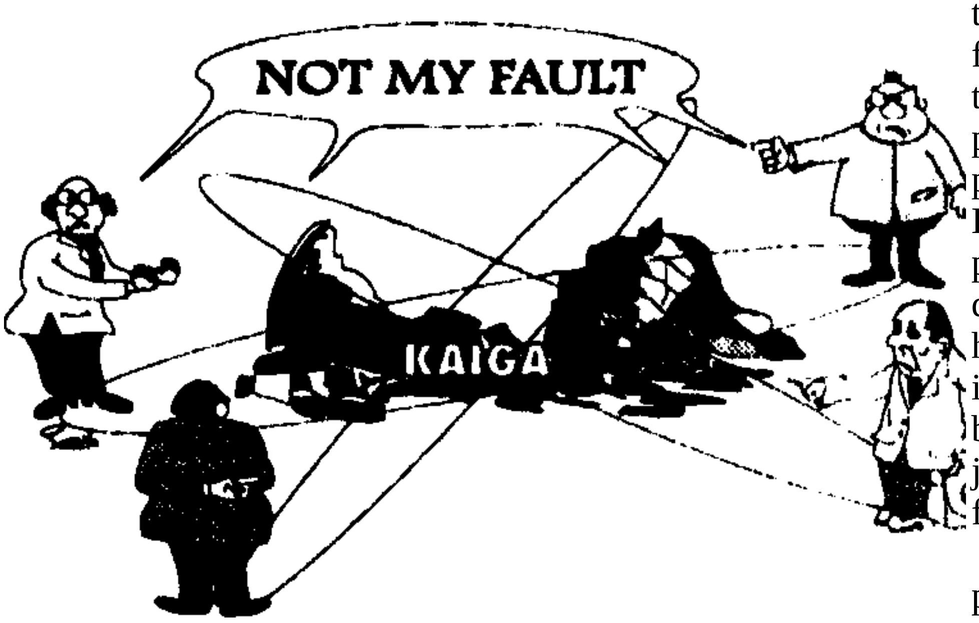
Accidents in the nuclear jargon are called 'unusual incidents'. The Indian nuclear programme is so accident prone and mishaps so frequent, that to call an accident unusual is a distortion of truth. They are, however, most peculiar. Where else in the world would one find the massive steel and concrete containment building collapsing on its own like a **house of cards.**

One thing we can always be sure of. Even in times of crisis, when all others would be worried sick and unable to think coherently, nucleocrats would **be calmly at work finding charming new words to enrich the English language. Their description this time for a 130 tonne chunk of concrete falling is 'delamination'.**

In 1988, hundreds of women of Karnataka, under the leadership of Dr Kusuma had 'raided' Kaiga and brought construction work to a halt by jumping into the foundations. Unfortunately, the momentum of those inspiring days has been frittered away and the Kaiga movement today is in a state of coma. The same inertia grips the antinuclear movement everywhere. It is high time that we heed the warnings of the nuclear volcano. **Unless we put an end to our indulgence towards this insanity we are bound to suffer the sorry fate of victims of nuclear violence.**

A Double Wall off Deceit and Disinformation

The bizarre mishap at Kaiga during which a portion of the dome crashed down is a matter of utmost concern. The lives of thousands of innocent citizens around our nuclear reactors depend on the integrity of the containment structures. We have been solemnly assured by our nucleocrats that the containment structures provided by them are the safest, capable of withstanding earthquakes of the order of 6.5 on the Richter scale, or a bomb attack by an enemy warplane. Even if the reactor were to explode like a bomb, as has happened in Chernobyl, the integrity of the dome and the safety of the people will not be compromised. They are supposed to be designed and built to contain the radiation from the reactor under all adverse circumstances throughout the life of the plant.



The Nuclear Community Speaks in One Voice

And yet, within four months of its construction, the containment structure of Kaiga has come crashing down under its own weight, without any external influence whatever. If such a mishap were to occur with the reactor in operation, the consequences would be devastating. The steel and concrete debris of the collapsing dome would damage the core and leave it exposed like a smouldering radioactive volcano. The entire population of Uttar Kannada and Goa will be in danger and will require immediate evacuation. Neither the government of India nor the Atomic Energy establishment is in any way equipped to handle a disaster of such magnitude.

The exact reason for the ,mishap **at Kaiga is not yet known. Whether it is poor design, substandard materials or defective workmanship** or **a combination of** all **the three is to be established. What is the extent of corruption in the project ? Are safety norms being thrown to winds** so **that the project is somehow completed in time ? The people have a right to know the answers since it is a matter of life and death.**

Unfortunately our nuclear establishment is not answerable to anyone — the people or the Parliament. For decades they have been conducting their covert operations behind a double wall of deceit and misinformation. Every effort will now be made by them to suppress the serious nature of the Kaiga accident and pass it of as 'minor' and 'inconsequential'. Till date they have not disclosed the true extent of the damage or the number of casualties. Injured workers have been kept in custody and are not allowed to meet anyone.

We demand a comprehensive inquiry into the causes of this moat serious accident, by a team of independent experts who will not be influenced by the nuclear establishment. We reiterate our stand **against the** folly of setting up nuclear **power plants** anywhere, especially in ecological sensitive areas like **Kaiga.** Such shoddily built power plants pose a grave danger for the environment and the public. Despite all the money already wasted on it, there can be no justification for continuing the project at Kaiga. We urge the Government of Karnataka to take the initiative and place before the people, all the details of the present and the past accidents at Kaiga and their possible consequences on public health. Let a well informed citizenry be the ultimate judge of the need for such projects.

Already several politicians at the local and state level have voiced their opposition to the continuance of the Kaiga project. In an election year, it is natural for those in politics to define their attitude according to the voters' moods. Our opposition to Kaiga has always been purely on environmental and developmental principles. We sincerely urge everyone, including the political parties, to take a firm, principled stand and stick to it even after the elections.

Sanjay Havanur
Co-ordinator CANE, Bangalore

The Dome off Death

Trust the nucleocrats to come up with something truly bizarre. For years we have been bombarded with tall claims of the superiority of our double containment structures. They are supposed to withstand the worst of nature's furies. I remember a leading nucleocrat claiming that in the event of an earthquake the safest place to run for shelter would be your neighbour reactor building since it is built to withstand jolts of 6.5 magnitude on the Richter scale. They can survive bomb attacks - either by terrorists or by enemy warplanes. Above all they must withstand the internal stresses from the reactor core itself, including the tremendous pressures built under loss of coolant accident conditions.

No problem, say the nucleocrats. We have double containment structures you see. They form the fifth barrier against the radiation escaping from the core. "The containment provisions are proof tested to establish beyond any reasonable doubt that they are capable of withstanding the pressures that are expected in the case of an accident." A Chernobyl type of disaster, where the reactor core was totally exposed to the environment, just cannot happen in India. We have not just one but two containments so we should feel doubly safe.

But not quite. The term 'double containment structure[1] implies a 100% redundancy in protection which simply is not there. The first containment is a 300 mm thick wall of pre-stressed concrete designed to contain a pressure of 1.25 kg/sq. cm. But the second containment is a much thinner wall of RCC designed to hold against only 0.07 kg/sq. cm of inner pressure. In other words, it is designed to contain the gases leaking out of the first dome. If in an accident, the inner containment were to be breached altogether, the outer one would automatically cave in, exposing the core.

There has been a long and unresolved international debate as to whether reactor containments can really hold out against a LOCA. For one thing the actual stress on the dome in an accident has obviously never been measured. Given the complexity of the problem, one has to rely entirely on computer simulations for the answers. But these answers are only as reliable as the model used for the simulation which again is supplied by the nuclear scientists. Our own nucleocrats, true to their style, have never disclosed any meaningful information on reactor safety except for banal assurances of 'highest degree of safety' and 'defence in depth'. The antinukes have had their doubts about the integrity of the containment structures but kept their dark suspicions to themselves.

But what happened at Kaiga has been beyond their wildest suspicions. How could anyone have ever doubted the ability of a reactor containment, even the one being built by NPC of India, to withstand its own weight? On the afternoon of Friday the 13th (touch wood!) May, a massive slab of the inner containment of Reactor I detached from the dome and crashed. The earlier reports said that only one slab about 6.5 meters wide and weighing 20 tons had fallen. But the more recent reports suggest that nearly *40%* of the inner portion weighing a massive 130 tons have got 'delaminated'. The dome was completed last January but plumbing, cabling and other works were going on. Both NPC and AERB have set-up separate committees to investigate the mishap. The AERB committee, under the chairmanship of a rather inappropriately named Professor V N Gupchup, has been asked to submit its 'first interim report' within two months. The committee will also decide whether the fallen dome can be repaired or has to be rebuilt entirely

But the real and the most frightening issue is not accident itself but what it implies., The consequences of such a mishap inside a working reactor would be nothing short of nuclear catastrophe. In the worst case scenario, the falling debris of a shoddily built dome would damage the coolant pipes and other safety mechanisms. The core would suffer a loss of coolant with all safety mechanisms unavailable. With the containment roof having caved in, the core would be fully exposed to the environment like a smouldering radioactive volcano. It would be another Chernobyl and given the sheer incompetence with which our official machinery handles an emergency, the immediate death toll could well be in hundreds of thousands.

The AERB on its part has already issued directives to halt the construction work not only at Kaiga but also at RAPS III and IV. But the NPC seems more adept at splitting hairs rather than its atoms. The directive has been interpreted to cover only the civil construction of the inner containment. All other construction work at Kaiga will continue. However, there is another major threat to public safety that AERB has not recognised. The Kakrapar reactor has also been completed in a desperate hurry and with total disregard for safety. It has gone critical without adequate testing of basic safety systems. What guarantee do we have for the integrity of its containment? AERB must immediately order for the closure of Kakrapar and make a thorough investigation of all its safety mechanisms, including that

I KNOW THERE ARE HARDLY ANY TREES LEFT IN THIS RAINFOREST BUT YOU STILL CANNOT SIT ON NUCLEAR PLANTS
KAIGA

of the containment structures. With thousands of lives at stake, we simply cannot afford to take any chances with these domes of death.

A number of theories have been proposed to explain the Kaiga mishap. The most far fetched one is that a geological fault passes right through reactor foundation. It might have thrown up a mild tremor, not' strong enough to be recorded any where but sufficient to cause the collapse of the dome. If this is true, it only vindicates the environmentalists' arguments against the site selection. But the more plausible causes are faulty construction methods and sub standard materials, not withstanding the righteous claims of NPC about using only tested, materials of the highest quality. The nuclear establishment's culture of secrecy and absence of accountability leads invariably to corruption. It has been alleged that the markets of Uttara Kannada are now flush with high quality cement, steel and other construction materials. Sometime ago the roof of the fire station building at the site too had collapsed when a conventional structure of cement in a Government project collapses immediately after it is built, the reasons are quite obvious; A local was put it neatly when he said that the contractors will collect their bills but leave behind a Chernobyl!

Having been severely criticised for the 300% overruns in cost and time incurred in all of its projects, the nuclear establishment has been hell bent on completing the Kaiga project on schedule at any cost. The question is whether safety concerns have been thrown to the winds in the process. It is already established that the actual construction done at the site was different from the plans submitted to and approved by AKRB. Also, several processes such as stressing sequence for the concrete were carried out without AERB's approval. Were the engineers at site authorised to make design changes? Were they competent to do so? If not, do we understand that the designs of our atomic power plants are subject to incompetent and/or unauthorised changes at site?

Immediately after the accident, the NPC officials closed the reactor building and barred entry. However, a team of women activists, led by the intrepid Dr Kusuma Sorab, visited Kaiga late in the night and spent some time with the labourers who live in sub human conditions around the site. They are a frustrated lot and accuse the contractors at site of all kinds of malpractices in construction. They also claim that there have been other accidents at Kaiga involving casual workers. Compensations have been promised but never paid.

There is one aspect of the mishap that still remains shrouded in mystery. How is it that no fatalities have been admitted by NPC? Officially only 14 workers working above the dome suffered minor injuries. Only one of them is still in hospital, under strict police custody. The explanation given by Mr B. A. S. Prasad, chief Administrative officer is that the mishap occurred during lunch time and hence no one was inside the dome. The coincidence apparently has reaffirmed Mr Prasad's faith in God. But lunch hour at 11-45 AM at a construction site is too hard to swallow. Besides, what were those fourteen people doing on top of the dome during lunch hour? One of the workers, who was on the dome has little faith in Mr Prasad or God. According to him, at any given time there are at least 200 people working inside the reactor building. When the inner wall of the containment began to fall, a lot of dust was kicked up and no one could see anything. The local police were informed of the accident only late in the night. All this leads inevitably to a disturbing question. Has Kaiga already claimed its first human victims?

Sanjay Havanur
Bangalore

Only Public Action Can Ensure Safety

he latest disclosures by the Atomic Energy Regulatory Board about the May 13 accident at the Kaiga atomic power project should make us all sit up On that day, a huge slab of concrete from the under-surface of the containment dome of Unit-1 of the plant, weighting 130 tonnes and with a diameter of 42.6 metres came crashing down.

According to spot reports, about 200 workers were inside the building. Miraculously — going by the Nuclear Power Corporation's account, that is —only 14 of them were injured. The public's suspicion that the damage might have been greater have not been assuaged by the fact that the iiyured workers are in police custody and incommunicado.

Only a full inquiry will, hopefully, fix responsibility for the accident. But meanwhile, the mishap has blown a big hole into the department of atomic energy's (DAE) claim that the containment dome, part of the essential safety systems at nuclear power stations, is itself a safe structure, reliably designed to withstand earthquakes of magnitude 6.5 on the Richter scale (about the same as Latur), or aerial bomb attacks.

Principal Barrier

Theoretically, the containment dome is, as the name suggests, meant to contain releases of radioactivity from the reactor it encloses. It is the principal barrier between vast quantities of radioactivity liable to be released in a mishap, and the public. In practice, it does not work that way: at Chernobyl, for instance, the force of nuclear explosion was 90 times greater than the level the dome was designed for.

Kaiga highlights the sinister possibility of the containment dome causing rather than containing a nuclear accident: had the plant been working "normally" when the mishap occurred, nothing could have prevented a catastrophic accident even a core 'meltdown'.

The possibility does not look lees menacing when the AERB reveals that reputed firms such as Larsen & Tbubro and STUP Construction of France were involved as builders and consultants of Kaiga. Indeed, according to the AERB, they made a major, unsanctioned alteration of the construction design, perhaps to speed up work, changing from construction joints at the circumference to "meridinal construction joints".

It is not known if STUP made these changes with NPC's knowledge. But it is clear that the accident could not have occurred without a departure from sound working practices and safety codes and a lackadaisical, if not reckless, attitude to safety. This is not unique to Kaiga, but widespread at Tarapur and Rajasthan - where hundreds of workers have been exposed to excessive doses of radiation, as this paper disclosed-Narora, where a devastating fire occurred in March 1993, or at the Indian Rare Earths plant at Alwaye where there is a horrifyingly high incidence of Down's Syndrome among the children at DAE installations is scarcely reassuring and certainly no better than in industry, in general. But the consequences of a breach of nuclear safety norms are disproportionately greater, indeed enormous.

Special Category

It won't do to dismiss the Kaiga accident as inconsequential or something that the system can somehow deal with. It belongs to a special category of worrisome accidents in a high-hazard industry, discussed by the Yale sociologist Charles Perrow in his remarkable book, *The Normal Accident.* It confirms the worst fears of activists who have been agitating against the Kaiga plant for almost a decade.

Here lies a lesson, the AERB is just not good enough to do the job of regulating the DAE for safety It needs more teeth, more expertise, more demanding inspectors and more punitive powers and, above all, full autonomy.

Only an AERB which is detached from the DAE and reconstituted to include independent experts and concerned citizens can satisfy two elementary ethical requirements, viz., those who regulate, supervise or judge should, operate and hence may be in the dock; and, secondly, that people who are liable to be affected if a development project fails must be associated in deciding on its desirability, its operating practices and safety '

Now this is precisely what we have failed to do in India. We have invested heavily in activities with potentially harmful consequences for the public without bothering to create mechanisms to regulate them, or to deter and punish violations of safety standards. And we have blindly relied on "experts"the scientific bureaucracy, to make decisions about true worth of large dams, flyovers, chemical plants or pesticides-intensive agriculture. Often, our political leaders are more open to issues of technology and its hazards than our scientocrats and "experts". The "experts" are Usually too smug, dogmatic and closed in their attitudes to want to engage in serious, open debate.

However, a larger leeson is that even political leaden cannot be trusted to be objective, informed and fair-minded. The only remedy lies in public action. There is simply no substitute for involving the public - the ultimate criterion of benefit, and also the potential bearer of the cost- in the evaluation, clearance and supervision of projects, stipulation of safety standards, and hazard reduction and disaster management. The US has a system of public hearings on dams. The idea must be enriched and extended to all large projects in this country.

***Prafut** Bidwai*
Times of India June 2. 1994

National Profile off X-ray doses

Two years from now, India will be among the few countries in the world to have a national profile of X-ray doses, according to the Atomic Energy Regulatory Board which has embarked on an ambitious research project to gather exhaustive data on radiation doses to patients undergoing X-ray examination in thousands of hospitals and polyclinics spread across the country.

Medical X-rays were first used in India within three years of their discovery. The rays were brought by the Indian Army to the North-West Frontier Province and used effectively by Surgeon Major Bewoor. Following his success, base hospitals in England were later equipped with the diagnostic and therapeutic tool As per latest estimate, about 81 million medical X-ray exposures are taken annually in India, using 50,000 X-ray units operated nationwide. Nearly 1,500 new units are added annually.

Eleven scientific institutions including the Institute of Nuclear Medicine Delhi; Christian Medical College, Vellore; Kidwai Memorial Institute of Oncology, Bangalore; RST Cancer Hospital Nagpur and Irwin Group of Hospitals, Jamnagar have been involved in the project titled "Evaluation of Patient Organ Doses during Diagnostic Radiology."

"Radiology officers will visit all the X-ray centres in the country to collect the data on a proforma prepared by us which will later be fed into our computer," said secretary AERB Dr. K. S. Parthasarathy

The project, first of this kind in Asia, is being undertaken following suggestions made by the International Commission on Radiation Protection that "some dose constraints must be arrived at by the regulatory body or professional organisations". According to the international body, the ranges of radiation doses in X-ray investigations were found to vary by as much as a factor of hundred. AERB's inputs will give valuable inputs in this decision making*

The AERB has sanctioned an amount of Rs. one lakh per institution for a year for the job. The collection of data which includes type of radiological exams, frequency, sex and age group will be conducted by radiological safety officers.

Hiren K Base
The Independent May 6.1994

Comment

Hiren K. Bose's report "National profile of X-ray doses" ascribing to the International Commission on Radiological Protection the statement that *"ranges of radiation doses in X-ray investigations were found to vary as much as a factor of hundred"*, if true, may have criminal negligence implications to those causing exposure to ionising radiation. A patient who should have received no **more than 8.4 millirems for a chest X-ray might have been exposed to 850 millirems ! This is not a hypothetical situation but has actually happened abroad. Between 1985 and 1989, in a community called Sittensen between Bremen and Hamburg in Germany, children were overexposed to diagnostic X-rays by as much as a factor of ten which resulted in more than seven hundred percent (700%) leukaemia occurrence amongst them as compared to children of the control area (the Mainz). In the February Annual Meeting of the American Association for the Advancement of Science, a session on breast cancer included many presentations linking breast cancer with medical X-rays. At the same meeting, Dr. Samuel Epstein, a professor of medicine at the University of Illinois at Chicago, speaking at a panel session on breast cancer research policy in the USA. said that the expanding use of X-ray mammography to screen women for breast cancer in the USA, was "reckless, if not criminal". In view of this, it is not only essential to gather exhaustive data on radiation doses to patients undergoing X-ray examinations, but to follow up of the patients themselves till their death* What have been the consequences of this reckless practice on unsuspecting uninformed people? There has to be an independent watchdog body having no conflict of interest like that of the nuclear industry; supervising the data base.**

R *Ashok Kumar*

Twenty Minutes That Shook BARC

India's controversial atomic energy establishment has had yet another close brush with infamy. The CIRUS research reactor at the Bhabha Atomic Research Centre was just 20 minutes away from a "major disaster" last month following a "grave procedural error".

The "incident" occurred around 11 am on April 12 when operators at CIRUS failed to connect a water pipe to a spent natural uranium fuel rod that had just been taken out from the reactor for refuelling. There were no injuries or deaths. Department of Atomic Energy sources first said the incident could have measured '2'on the International Nuclear Events Scale, just below the Narora fire incident last year which measured '3' on the same scale, but later pegged it down at level '1'.

The operating licences of the entire crew, comprising five operators including the shift in-charge, have been withdrawn for a period of six months with immediate effect following the incident.

Dr A Gopalakrishnan, chairman, Atomic Energy Regulatory Board, which monitors safety aspects in nuclear reactors, confirmed the incident, and said a committee had already been formed to do a root cause analysis of how it occurred. A report is due in three weeks time.

DAE sources said the incident was another pointer to a "safety culture problem" prevailing within the BARC where CIRUS is located. "Last month they forgot to connect a water hose. What will they do tommorow?" However, BARC Director A. N. Prasad downplayed the incident: "There is nothing so serious about what happened on April 12 so as to deserve being reported. We know how to manage such things. The AERB is there, and we are answerable to it. Just leave us alone."

When an exhausted fuel rod— that is natural uranium that has been used up by the reactor to generate power -is taken out of the reactor, it is moved to the spent fuel bay, This is done by. first moving it into a 10-feet-long cask and then transferring it into a spent fuel pond.

Usually, when the rod is removed and is being moved to the top of the cask on the way to the pond, cooling is provided, as there is still some heat in the spent fuel element. The heat is enough for radioactivity to be released into the atmosphere if it is not cooled.

> *"We know how to manage such things. Just leave us alone."*
>
> A. *N. Prasad Director BARC*
>
> 'I *am only hurt that people think we need policing."*
>
> *S. K. Chatterjee Director*
>
> *NPC*

When the rod is within the reactor, there is no such problem, as it is automatically and constantly cooled. An official in the know likened the procedure to a child in a mother's womb. "As long as the baby is inside, it does not have to wony about nourishment. But the moment it is out, it has fend for itself". But the moment the rod is taken out, the cooling is done by connecting a light water hose to the cask. But on April 12, it was not, And the discrepancy was not noticed for at least 20 minutes by which time slight radioactivity had been noticed in the precincts of the reactor. Otherwise the rod would have overheated with disastrous effects. "If another 20 minutes had lapsed, we would have had a major problem on our hands. The temperature of the spent fuel would have shot up and the rod could have ruptured spewing radioactivity within the reactor establishment," one BARC source said.

Fortunately, the reactor- which has been operating at 20 MW capacity, half its installed capacity- had been shut down, when the incident occurred. "If such an incident had taken place in a power reactor, it would have been a totally different case," the source added.

S. V. Kumar, chairman of the AERB's safety review committee of operating plants, said the point to ponder was why the operators failed to connect the water hose to the spent fuel element. He, however, agreed that it was a matter of concern that such incidents were regularly being reported from CIRUS and its sister reactor Dhruva.

However, S Shankar, who heads the BARC reactor division, said the incident was not serious. Such incidents, he added, occurred the world over in all other industries and the CIRUS one was just one such. No more.

DAE sources revealed that the cask operator had, on the other hand, reported at least four times on April 12 that the flow of water was okay, even though no water was flowing to the spent fuel element, as the water hose had not been connected at all.

CIRUS was installed in 1961 and is said to be of vintage quality.

'The point to probe is whether the flow meters which have been provided to the operators of CIRUS are in working condition or not. If they are not, then it is very likely a case of dereliction of duty." the sources felt.

CIRUS reactor superintendent R C Pant declined comment, saying it was up to the public relations wing of BARC and AERB to confirm or deny the incident, and ascertain the veracity of its magnitude.

R. K. Sehgal, an activist for greater safety at nuclear establishments, however, felt too much was being sought to be made of the April 12 incident in an effort by the DAE to whitewash its previous lethargy in dealing with more serious incidents.

"The environs of the CIRUS Dhruva complex have been contaminated for years due to rupture in a pipe carrying radioactive fluids. Yet all the people responsible for that have gone scot-free. Why?" he asked.

The five delicensed operators will not have to seek requalification when AERB conducts its review examinations six months down in the line. However, they will continue to draw their salaries.

Krishna Prasad
The Sunday Observer,
May 7, 1994

Containment: The Ultimate Barrier

Kaiga Dome Falls ... Collapses... Concern Over Kaiga Mishap.. Union Government Urged Thorough Inquiry... Matter Serious... NEWS 18th May, 1994

Of course the matter of the dome collapsing is serious. It has been the boast of Indian nucleocrats that our PHWRs - the pressurised heavy water reactors have a dome within a dome! And hence, the public can rest assured regarding safety.

At the Third International Symposium on Small and Medium Size Nuclear Reactors New Delhi August 24-25,1991, hosted by IAEA and others at least three papers devoted considerable space and time to dome design. A. K. Babar, V. Venkatraj and A. Kakodkar of BARC, in "Pressurised Heavy Water Reactor in Public Domain", state: "A comparison of core damage frequency of PHWR with that of PWRs (pressurised light water reactors) has been made and the advantages of a PHWR are explained from the viewpoint of public safety The studies show that because of the design safety characteristics of a PHWR (e.g. presence of cool moderator as a heat sink under accident conditions, calandria vault cooling system, double containment etc.) the impact of worst case accidents in the public domain is not likely to be any greater than that of the design basis 'accident'. However, just two years later D. V Gopinath, Director of health, safety and environment group at RARC won the "Never too late for Realism Award" of *Anumukti* for his statement: "Emergency situations beyond the design basis of nuclear power plants cannot be ruled out." (September 1993).

Nucleocrats frequently reassure us that containments are built carefully keeping in mind their extraordinary importance. Eabaret al state: "Because containment is the ultimate barrier in the case of an accident, particular care is exercised in containment design. The principle of double containment is used and care is exercised that this provision extends over all penetrations and leak paths. The layout considerations require a rather large containment for the PHWR. This augments safety by enabling reduction of hydrogen concentration, in the event of an accident." What is left unsaid in this is the fact that in case of fire, the explosion ratio is reached easily and quickly because of the consumption of the large volume of air confined in the dome? Remember lust year's Narora explosions!

let us look at the extraordinary faith Indian nucleocrats repose in containment as a cure all safety feature. "A large number of accident sequences have been analysed, and it has been found that as long as containment is available, there is virtually no additional impact in the public domain regardless of the accident scenario considered. It has also been established that there is no possibility of a threat to containment integrity. Similar conclusions have been reached for similar reactors abroad. It must be mentioned here that some of the sequences considered in the above study include failure to effect a prompt shutdown following a LOCA (loss of coolant accident). Such a sequence is highly improbable. Further, based on a study of the consequences of this accident sequence and considering the resulting metal water reaction, hydrogen generation and energy liberated, it is observed that the impact in the public domain is not greater than that already considered for the design basts accident. This is so because, even though the release from

the core would be more *assuming the availability of the containment, the impact would be confined within the exclusion radius (1.6 km). This brings out the important role played by the containment and validates the importance attached by designers to the evolution of a sound indigenous containment design for PHWRs, so that it effectively limits the consequences even when the entire inventoty of 1-131 and noble gases is assumed to be released from the core."*

Another paper "Distinctive Safety Aspects of Small and Medium Sized Nuclear Power Plants in India", by M. Das and L. G. K. Murty, Nuclear Power Corporation, India talks of *"a double containment that exhibits a forgiving behaviour under hypothetical overpressure conditions"* and says it contributes to a design which would ensure that severe accident probability is Very low' and *'even if it were to happen, it can be fully contained*.* Again: *"the containments are built sufficiently strong to tate care of LOCA and seismic events occurring simultaneously".*

And yet, the dome just collapsed! The big chunk of concrete dropped down from a height of about 40 meters, says the news report. Despite the fact according to locally stationed engineers that "building activity has been subject to stringent quality control".

Another paper devoted especially to the reactor building structure in the New Delhi symposium referred to above, "Design Strategy of New 235 MWe Indian PHWR Reactor Building Structure", by PC Basu, Head Civil Engineering Section, AERB, A Dasgupta, Chief Engineer (civil and structural), Development Consultants Ltd., Calcutta, and HN Batavyal, Executive Director Development Consultants Ltd., Calcutta, attempts to delineate how the safety objectives in the 'new' design of reactor building structural systems for PHWRs in India are fulfilled: 'Systematic method for handling both internal and external hazards generated due to man-induced and natural events in the design is presented.' The paper especially mentions that the design takes care of internal hazards which are listed as fire, internal missiles, failure off pressure parts, 'pipe whip' and jet impingement, blast effects and compartment pressurisation, internal flood, heating and condensation, dropped load, explosive gases and impact during construction. Further it mentions that *impact during construction and dropped load hazards are avoided by proper administrative control and control in the system design.*

"The configuration of internal structure is so developed that the structural elements which invite more stringent design criteria is protected, to the extent possible, from the internal hazards by the structural elements wliose design criteria are relatively less stringent."

According to the paper the design approach is as follows: "Two classes of uncertainties—primary and secondary are dealt with. The primary uncertainties are associated with system uncertainties while secondary uncertainties are introduced in the design due to the limitation of data and knowledge (what are they?) of different aspects of design procedure and the state of the art. (In other words in nuclear reactor systems where no acts of the devil are permitted, they admit precisely this is possible, because of the fact that nuclear design is immature). They state: *"The dispcuity between the predicted behaviour of the analytical model and the actual behaviour of the structure introduce secondary uncertainties and this reduces the confidence in design."* Perhaps herein lies the real explanation of the Kaiga dome collapse.

They continue: "The primary uncertainties may be taken care of using characteristic values considering the randomness of the design variables like load, material properties, etc." This calls for probabilistic design approach of structures. However, experience shows that structural design in deterministic format following 'certain guidelines' also guarantees reliability in design. The deterministic methodology are adopted to design for structural integrity and serviceability. The secondary uncertainties are minimised to the extent possible. For this purpose the configuration of structural systems requires that the available proven analytical tools are applicable with high degree of confidence. However, all the design uncertainties cannot be addressed through analytical design. The remaining ones are to be taken care of by a systematic quality assurance programme.

"The approach to hazard in design and the concern for minimising secondary uncertainties are kept in mind during ail stages of engineering i.e. siting, conceptual development, structural- layout, analytical design, and construction, the above activities are not independent but are inter -dependent, therefore, design strategy adopted must be such that the total safety is ensured through all these stages."

The above description makes it amply clear to the layman that there indeed may be an infinite number of slips between the cup and the lip, concretely, for a change! Well, that is just the unforgiving nuclear technology.

R. Ashok Kumar
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Some Lessons in Nvcleonomics

Recently I have been reading Nucleonics Week, a nuclear industry journal. Below are some excerpts from it and other journals. Read together they give a picture of the financial state of the nuclear industry today. They also shed some light on the alliance between Third World bureaucrxUs and First World corporate tycoons.

Lesson Number 1: Nuclear power plants are three times more expensive to build as compared to nucleocrats' claims.

The Parliamentary Committee on Energy in its report to parliament has criticised the long delays in completing new nuclear power plants that have led to cost overruns exceeding 300%.

The Kakrapar Atomic Power Projects two 220-MW pressurised heavy water reactors (PHWRs) using natural uranium fuel- was originally estimated to cost Rs 3.8252 billion but the cost has been revised to Rs-13,35-billion. The first unit began operating in May 1993 and the second is expected to go critical later this year. The fiscal 1994 federal budget (through March 1995) provides some Rs 400-million (about $12.9-million) for the project.

The Rajasthan Atomic Power Projects third and forth 220-MW PHWRs were estimated to cost Rs 7.1157-billion, but the estimate has now shot up to Rs 21.07-billion. The Kaiga Atomic Power Projects' two units, also 220-MW PHWRs, was approved at a cost of Rs 7.3072 billion, in 1987 but is now expected to run over Rs 22.76 billion.

"The committee feels that the loos of benefits to the economy owing to time and cost overruns of projects cannot be overestimated," the report said, hoping the Nuclear Power Corporation, of India (NPC) will at least now stick to the revised schedule of completing the work.

The Department of Atomic Energy (DAE) has cited the rising prices and changes in the scope of mqjor activities as the main reasons for the steep cost hikes. The original estimates provided for only a 15% rise in costs, while the scope of work in each of the projects has increased due to what the DAE termed "the evolving safety requirements and continued technology evolution to conform to prevalent safety standards." Kakrapar-1 was originally scheduled to operate in December 1990. Rajasthan-3 and -4 were to be commissioned in May and November 1995, respectively, and Kaiga-1 and-2, in June and Deoember, 1995. The revised schedule hopes to have all four ready by March 1997.

The FY-94/95 budget provides some Rs 2.9518 billion for the nuclear power projects still under the governments direct control like the Rajasthan station, fuel inventory, waste management facilities at Tarapur and Kalpakkam, and Heavy Water Pool management. About Rs. 11.83 billion is provided for new power projects being implemented and planned by the NPC, which now functions as an autonomous compaity

The budget allocates R.4.13-billion for Kaiga and Rs 3.53-btllion for the new Rajasthan units. Tarapur-3 and 4, whose approved cost is Rs 24.27-billion, will get Rs 2.46-billion during FY-94/95 compared with Rs 600-million in FY-93/94. The Tarapur units are to be 500-MW PHWRs. Reporting on the progress of Tarapur, the DAE said the final award for acquisition of land has been issued. Most of the components for one unit have beon received- During 1994-95, civil works contracts are expected to be awarded and preliminary work will commence. The two units are scheduled to be completed by the turn of the century.

Neel Potri, Nucleonics Week,
April 28, 1994

The Same Story Across The World

A report prepared by the Federal Audit Court of Brazil contends that the cost actually incurred in building Angra-2 nuclear power plant are way above those released to the public. According to the utility Furnas Centra is Eletricas SA, the total cost so far for Angra-2 has been roughly $ 4.6 billion and an additional $1.5 billion is needed over the next five years to finish the project in 1999, Half the new money is expected to be financed by German banks (the pro ject is German assisted and the construction is by Siemens). However, the Federal Audit Court says that Angra-2 has actually cost $6 billion during 15 years of construction so far, excluding financing, and the auditors estimated that $2.3 billion will have to be spent to complete the plant. Since financing of Angra-1 amounted to approximately 40 % of the nominal construction costs, the auditors put the total costs including financing of Angra-2 at well over $10 billion.

"lb Furnas it does not make any difference to construct a hydroelectrie plant or a nuclear plant, seeing that the government subsidises the cost of nuclear energy," wrote an auditor in reference to the Brazilian law which subsidises Angra«l. A proposed law granting a similar subsidy for Angra-2 is currently in Brazil's lower house. If the bill passes, Furnas' financial participation in constructing Angra-2 will be limited to the cost of a hydroelectric plant of comparable size.

'This means an investment of only $1*2 billion for the utility, whereas the difference of $6.1 billion will have to be absorbed by the taxpayers, in addition to the financial cost of the enterprise," said Rui De Goes, head of the local Greenpeace organization. 'This is the first time that the account of Angra-2 are out in the opun," enthused Goes, who said Greenpeace will request suspension of all work at Angra-2.

The conclusion of the audit with respect to Angra-1 are no less devastating. The auditors calculated a total construction cost of $3.9 billion and affirmed that this amount "represents a new level for the analysis of the cost profit relationship of Angra-1." In a September 1993 report, Furnas admitted a total cost of $2,375 billion, including $752 million in financing.

Armin Schmid
Nucleonics Week April 21. 1994

Lesson Number 2: Even The Best Plants Are Just Too Expensive To Operate.

The California Division of Ratepayer Advocates (DRA) has recommended that Southern California Edison's San Onofre-2 and 3 reactors be permanently closed by 1998. The DRA, a division of the Public Utilities Commission, is the same agency that recommended shutdown of San Onofre-1 a few yeare **ago, which resulted in its closure in 1992.**

According to the DRA, a shutdown by 1998 of San Onofre-2 and -3 would result in a savings to California ratepayers of more than $1 Billion over the life of the reactors compared to available alternative energy sources.

The DRA analysis even admits that the two San Onofre reactors have been among the industry's top performers in terms of capacity and costs. But, says DRA, existing bids from independent generators (QFs, or qualifying facilities) can ensure electricity production at a lower cost than simply operating San Onofre.

California finds that Its best run plants with plant load factors of more than 80% are "uneconomical" compared to alternatives.

How come Indian nuclear plants which cost three times their estimate to build and have plant load factors ranging between 20% and 60% are economical?

The DRA analysis does not take into account serious safety issues, such as the likelihood that during its lifetime San Onofre, a Westinghouse-designed plant, will have to replace or repair its steam generators, or remove and replace its fire barrier.

Instead, the DRA analysed only SCE's own anticipated operating and maintenance costs to come up with its conclusion that it is simply not economical to operate these reactors any more.

The DRA argued that not only are the QFs cheaper than the nuclear plants, but so are the utility's own demand-side management measuras. Indeed, DRA could not find a scenario in which the nuclear plants are cheaper than the alternatives, even in the unlikely event that the reactors run at above 80% capacity for the rest of their license period.

In short, using hard numbers and southern California's particular situation, the DRA cannot imagine the possibility that nuclear reactors could be economical.

If the DRA proves successful in its effort to protect California ratepayers, as it was in promoting the shutdown of San Onofre-1, the shock waves will be felt throughout the nuclear industry After years of defending cost overruns, unanticipated capital costs and so forth, in the hopes that simply operating reactors would prove cheaper than alternatives, utility executives could be called on the mat to demonstrate why they shouldn't close their nuclear reactors, simply because the operating and maintenance costs are too expensive. As reactors continue to age and face higher and higher maintenance costs, this appears a likely scenario. In the end, if San Onofre-2 and -3 are found uneconomical, it is difficult to imagine any reactor, which undergoes the same sort of rigorous cost-benefit analysis, that could be found economical. Once again, California may be leading the nation.

The Nuclear Monitor
May 9.1994

Lesson Number 3: The Costs of Decommissioning Reactors are Deliberately Underestimated

The Canadian Auditor-General is sharply critical of Atomic Energy of Canada Ltd (AECL) for failing to provide for expected costs of decommissioning facilities and restoring research station sites to green field condition over the next half century. In his report to Parliament on the 1993 accounts of all government departments, the auditor-general said the provision of $200 to $300 million failed to include the likely cost of "the most significant portion of decommissioning activities." The plan includes expected near-term costs for shutdown reactors, but not for research reactors and many facilities currently in use at the Chalk River and Whiteshell laboratories.

Quote of the Month

"/ will not say, you keep generating nuclear power even if it is uneconomical. But if you keep practising it, it will become more and more economical."

S.K. Chattarjee Director NPC
lnFrontine June 17 ,1994

Moreover, the auditor-general said, In future the corporation intends to provide an allowance for the costs of decommissioning and site remediation only to the extent that funding from external sources is realised." That was inadequate to properly determine AECL's financial position and could result in demands on Parliament for further funding in the future.

Ray ***Silver***
Nucleonics Week April 28,1994

Lesson Number 4: Whoever Does the Damage and whoever might be at fault, You Pick Up the BUI

The Clinton Administration is pushing for a new international treaty on liability for accidents in nuclear power plants. The treaty would globalise responsibility for paying damages in case of nuclear accidents with costs being shared by all countries that use electricity from nuclear power plants.

Western nuclear supplier companies, still eager to do business in the ex-Soviet Bloc, are balking at the current lack of protection aguinst legal action if they install equipment at plants that later have accidents causing third party damage. The treaty's immediate aim is to protect these companies.

Under the proposed new framework, damages for accidents would be paid out of an international pool of funds, to which each member country which has nuclear power plants would contribute. Every country that agrees to sign the treaty would contribute at least about $ 280-million for accidents that occur within its borders.

The proposed treaty puts a limit of $ 1.4-billion in damages for any nuclear accident. The estimate is that at the most, a country would have to pay $ 105-million for accidents that might occur outside its borders—but the exact amount would depend on the amount of nuclear power it uses.

Existing U.S. law, which will continue to be operative even after the proposed treaty is signed, provides up to nine billion dollars in liability coverage of a nuclear accident as opposed to $1.4-biilion in the proposed treaty.

Indian Express ***June 7,1994***

Lesson Number 5: Despite the Hidden Subsidies, Private Executives Answerable to Shareholders, Have No Confidence In Nuclear

Senior U.S. utility executives are less confident today about U.S. nuclear power's future than they were two years ago according to a survey. Released by Washington International Energy Group, a consulting firm, the survey is based on responses to a four page questionnaire covering a wide variety of issues.

Asked if there will be "a resurgence of nuclear power in the U.S." only 37% of respondents answered yes. Two years ago, 68% said there would "definitely or "probably" be a rebirth. Asked, "Do you think your company would ever consider ordering a new nuclear power plant?" 721 of the respondents said "no" this year, up from 57% in 1992. What's more, just 9.5% said their companies might consider ordering a new plant, down from 13.8% in 1992 and 16.5% in 1993.**

The report, "1994 Electric Utility Outlook," notes that by nearly every measure, the quality and safety of nuclear performance in the U.S. is at an all-time high. The public attitude toward nuclear is also lees stridently negative than in the past. Paradoxically, this success finally has been achieved at the same time that many Chief Executive Officers (CEO) have come closer to deciding that nuclear may not be able to survive in the competitive marketplace. Privately, many CEOs talk about someday turning over title of plants—even the best-run ones—to the government. Many more are preparing to write down their massive overhang of nuclear debt."

Nucleonics Week January 13, 1994

Third World Bureaucrats with Public Money to Squander Are Enamoured of the Charms of Nuclear Power!

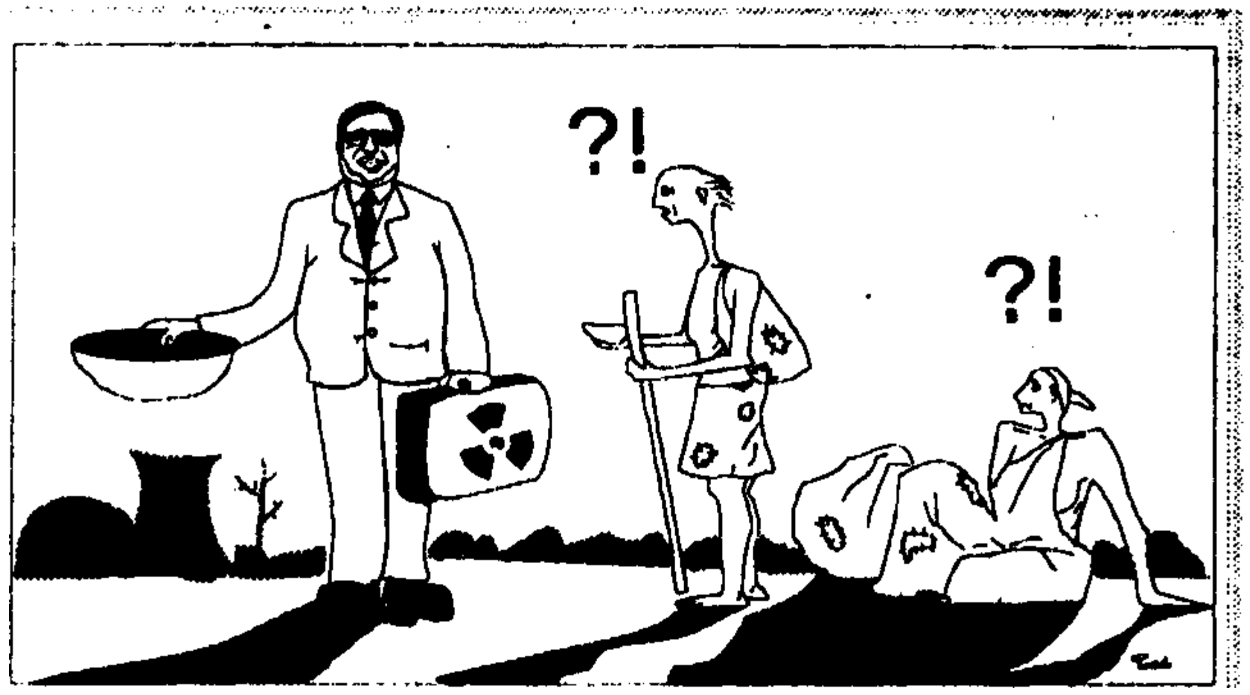
India's nuclear establishment, which has had to prune its plans for 10,000 megawatts of installed nuclear capacity by 2000 to just 3,800 MW in recent years because of money difficulties, is getting surprisingly positive signals from bankers and investors.

There were no takers for the Nuclear Power Corp.'s (NPC) bonds in the last two years. "Today I am able to borrow at low rates of interest from banks and financial institutions and even non-resident Indians" settled abroad, said S. K. Chatterjee, NPC managing director.

Current installed nuclear generating capacity is only 1,720 MW from nine reactors, just 2.5% of the country's installed power capacity The government has given the green light to the NPC to explore financing for joint ventures for plants and the NPC was able to tie up with the southern Indian states to set up a plant in the region with the corporation taking 51% ownership. However, the idea did not click with the western states like Maharashtra and Gujarat. One inhibiting factor seems to be the condition imposed by New Delhi lawmakers that the state-controlled NPC must be the majority owner with 51% equity. The NPC finds it tough to come up with even this much capital.

However, the corporation is thinking of building two 500 MW pressurised heavy water reactors at TWapur at an estimated cost of 60-billion rupees in addition to its ongoing projects. The government has indicated the NPC can go to financial markets to raise funds for this project, but the NPC has no source for its Rs 20-billion share other than the government, according to Chatterjee. He was confident the new-found enthusiasm among the bankers to come up with loans for nuclear power plants will help the NPC to go ahead with added capacity. The banks are now convinced nuclear power is economically viable in areas where there are no cheaper fuels like coal.

Nucleonics Week April 14,1994



The New Boy On The Street!

Bangladesh Considering Nuclear Power

DHAKA, April 22 (UPI) Atomic energy experts are urging Bangladesh to consider building a nuclear power plant in the Northwest section of the country. "Nuclear power is technically and economically viable for Bangladesh," they told Prime Minister Khaleda Zia during a secret cabinet meeting April 14, the Financial Express reported.

Officials of the Bangladesh Atomic Energy Commission told cabinet members a 300-megawatt nuclear power plant in Rooppur, 170 km (105 miles) from Dhaka, could be running by the end of 1995 at a cost of $600 million. *(Nobody, but nobody has ever managed to get a plant ixinning in less than twoyears!*—Editor)

Rooppur, on the banks of the Ganges River, was selected in the early 1960s as a possible site for a nuclear power plant. Nearly 300 acres of land already has been acquired for the purpose, the paper said. (Editor's Note: As is usual with nuclear sites, Rooppur is not traceable on any decent sized map of Bangladesh. However, from the description it should not be very far from the Indian border. Could friends in West Bengal take the trouble to send in its exact location?)

But a lack of funds prevented construction of the plant, said BAEC briefing papers presented to the cabinet and obtained by the newspaper. Bangladesh suffers from a chronic shortfall of electricity, particularly in the summer when total production of 1.800 megawatts fails to meet the demand of 2,200 megawatts. The country uses locally- extracted natural gas and coal and imported oil to generate most of its electricity.

Government officials reportedly already are looking into suppliers for reactors, including China and Germany if they decide on a 300-megawatt product and the United States and France if they want a 600- megawatt plant, the newspaper said.

Indonesia Ready to Go Nuclear

Indonesia's plan to build two 600-MW reactors will be put before the country's Energy Co-ordination Board within 60 days said Djali Ahimsa, *{most appediately named*—Editor) the director general of Indonesia's Atomic Energy Agency.

Mitsubishi, Hitashi and Toshiba, one Asian diplomat said, are ready to build a reactor in Indonesia as a loss-leader. "The Japanese want to get a foothold in the Asian nuclear power market which is expected to grow," he said.

In advance of the nuchar power project, Ahimsa said, Indonesia has already expressed interest in Japanese vendors'fuel cycle services. But Indonesia "still needs to assure the world that our programme is peaceful and transparent," he said. *{Heard thai one before?*—Editor) He said, "We are counting on foreign credit financing for 80% of the project and for 20% of the funds to be raised in the Indonesian market."

France Hopes For Power Surge In Asia

France's state owned power company Electricity de Prance (EDF) is shifting its emphasis in Asia from passive consultant to active partner according to Jean-Christophe Delvallet, the company's Far East Managing Director.

EDF played a pivotal role in helping China design and build the Daya Bay power station, a massive and controversial project near the Hong Kong border.

France's domestic energy market has been stagnant for several years, for EDF to look beyond its national borders for lucrative ways to expand the production and export of its energy. According to company figures, EDF earned a net income of $526 million last year, up 18 percent compared with 1992. The increase was possible in large part because of the company's export business throughout Europe. "Now we are developing a good understanding of how things work in Asia," Del vallet said. "It is going to be a very important part of the world for expansion."

Ian Stuart UPl April 13,1994

I Letter Box

You must be wondering who is more irregular and unpredictable—*Anumukti* or CANE members ! Let me assure you that *Anumukti* has been far more active and regular than us. Though for a few months when the little journal did not appear, I sort of took it as Good News. After all magazines like *Anumukti* are not needed in a sane society. If you don't feel compelled to bring out the journal, the reason may be that the nucleocrats are also not being very active.

CANE as such has become quite inactive. We met recently after a gap of several months, to discuss your letter regarding Dr. Gopalakrishnan's offer of talks. The general consensus was that we should go along with the proposal, though everyone had his own reservations. There were doubts regarding the motives behind the offer. I am also not convinced that AERB chief could be ignorant of health effects of radionuclides / radiation. In your letter you have suggested that his ignorance may be due to his engineering background, but being an engineer myself, I know that engineers are quite capable of understanding other subjects quite well. He may be testing the extent of your knowledge so as to use it in their campaign. But despite our apprehensions we all feel that the dialogue as suggested by Dr. Gopalakrishnan is a good idea. As a first gesture of openness why don't you ask AERB to send you *Nuclear India* regularly? (I did precisely that, and I have started receiving the rag along with *AERB newsletter* regularly. - Editor)

The news on Kaiga is somewhat encouraging. The Karnataka Chief Minister has declared that "all difficulties faced in the project have been cleared." Which means that the project has been having hurdles and will continue to do so. .

CANE has gone into such a deep slumber that most of us had forgotten about April 26 altogether. There is no follow-up on the Supreme Court directive to Ministry of Environment, either. The next step required was hectic lobbying from North Kannada, but they too have gone into a coma. (This letter was written just before the dome collapse in Kaiga. Hopefully the reverberations from the collapse will shake the antinukes not only in Karnataka but all over, from their lethargy. - Editor)

I also wanted to join issue with you regarding the tone of your editorials, specially about the chaos 'created'by your computer. Being antinuke is no license for being anti-technology. There are no alternatives to good technology and computers are very good technology. Our problem is to identify what is good technology and what is not.

Sanjay Havanur
Bangalore

Anumukti for postcards !

Postcards have disappeared from rural Gujarat. For months on ***end we*** *have* ***been trying*** *desperately to get a few and during our cycle yatra to Saurashtra we seq* ***hed*** *at each* ***and every*** *post office on the way without any success.*

Anybody sending in his or her subscription in the form of 200 postcards will not only get six issues of Anumukti, but two extra back issues plus ofcourse our heartfelt gratitude expressed on a postcard.

Anumukti Vol.7 Number 4 February / March issue, seems to me one of the best issues ever. I particularly appreciate all the information published about Ms O' Leary's revelations regarding the secret US nuclear experiments on their own population.

It was most interesting to read that AERB chief visited Vedchhi!

Every Indian citizen has the right to full scientific information in clear language. That is why I feel that each Anumukti issue should carry a short list of facts regarding what nuclear energy is and what it does. Knowledge is Power and one who knows can act and protest!

Sibylle Sharma-Hablik
Pondicheny

I enjoy reading Anumukti very much, for its informative yet chatty style. Alas, constraints of time and a total absence of activism in Nasik prevent me from much more than being informed about nuclear issues. But my good wishes and support are with you,

Sushma Sagar
Nasik

There are vague hints about revival of Koodankulam. I have requested Sister Agnes of Thiruchirapalli to continue the local opposition at Nagercoil to the planned and aborted Russian plant.

The recommendation of European experts to close down the functioning two Chernobyl plants is another proof of the utter futility of the existing plant. The upward revision of mortality at Chernobyl from initial 31 to now seven to eight thousand is utterly shocking but not wholly unexpected.

Any data on the health consequences of the exposed population at Rawatbhata should be published in lay press from time to time.

DrCN Deivanayagam Madras

I just got the latest Anumukti and I find that Dr. Zia Mian has sent you his articles which I had also received. If anyone contacts you, wanting copies of his articles **please** send their addresses on to me and I will send them Xerox copies.

H. Basappa
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